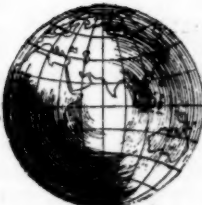


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SCIENCE AND HUMANISM

SPEAKING on the relations between science and human life in his Convocation Address to the Dacca University in 1932, Prof. Sir C. V. Raman observed that a false sense of values underlies the common belief that science derives its justification by its power to create wealth and new comforts and conveniences for humanity. But since science is equally capable of furnishing methods for the large-scale destruction of our civilisation, its true justification is to be sought in the marvellous success it has achieved in opening out a new vision of the universe, and more specifically in enabling man to perceive himself in proper relation to the universe he lives in.

In the course of a series of four lectures delivered at the Dublin Institute for Advanced Studies and published recently under the title "Science and Humanism", Professor Erwin Schrodinger has strongly emphasised the idealistic function of science and its spiritual bearing on life.* Schrodinger observes that the

practical achievements of science in the fields of technology, industry and engineering are more or less tending to obliterate its true import. Perhaps the fact that true scientific education is not much in evidence explains why a great majority of people seek to limit the goal of all scientific endeavour to just the improvement of our material conditions.

Schrodinger differs from the views of what he calls the "very scientific" circles, who make a virtue of the necessity for specialisation, and claim that the scope, aim and value of science is to be sharply distinguished from those of the other disciplines, such as art, philosophy and religion. In his opinion, the isolated knowledge obtained by a group of specialists within a narrow field has in itself no value whatsoever, but only in its synthesis with all the rest of knowledge, and only inasmuch as it really contributes in this synthesis towards answering the ultimate question: "Who are we?"

In the light of the fact that humanistic circles rarely, if ever, concede to science the right to answer the really important questions arising out of Life, the above pronouncement is indeed doubly welcome. Not only will the answer to the greatest of questions posed in the foregoing be incomplete without the contribution from science, but it is also made clear that science

* The first lecture deals with this aspect; the other three contain a masterly review of the state of 'Physics in Our Time', particularly in relation to the principle of causality, the question of impossibility of continuous observation and the inadequacy of "models" in describing the ultimate structure of Nature (*Cambridge University Press, 1951*).

cannot rise to its fullest stature, except by attempting to contribute its legitimate share in regard to every such question.

However, Schrodinger admits: "Not that we can avoid specialisation altogether: that is impossible if we want to get on". But he adds that all specialised research has real value only in the context of the integrated totality of knowledge. It is therefore gratifying to learn from him that the awareness that specialisation is not a virtue but an unavoidable evil is gaining ground, and that the voices are becoming fainter and fainter that accuse a man of dilettantism who dares to think and speak and write on topics that require more than the special field for which he is "licensed", or "qualified".

In this connection, it occurs to us that the counterpoise to specialisation is most effectively provided for by having more balanced courses in the Universities. As an example of what can be done in the beginning stages by our University lecturers, the following extracts from the report of the Commission for University Reform in Germany are worth quoting.

"Each lecturer in a technical University should possess the following abilities:

(a) To see the limits of his subject-matter.

In his teaching, to make the students aware of these limits, and to show them that beyond these limits forces come into play which are no longer entirely rational, but arise out of life and human society itself.

(b) To show in every subject the way that leads beyond its own narrow confines to broader horizons of its own."

It is the rounding off at the advanced research stage that raises great difficulties. It is obvious that for this to become fruitful at all, we need to have on the rolls of our Universities men distinguished no less for their catholicity and range of interests than for their scientific worth.

Let us hope that to some at least of our Universities it will be given to discover men who can with confidence preach and practise the following commandments of Schrodinger's: "Never lose sight of the role your particular subject has within the great performance of the tragic-comedy of human life; keep in touch with life—not so much with practical life as with the ideal background of life, which is ever so much more important, and keep life in touch with you."

INTERNATIONAL STATISTICAL CONFERENCES, 1951

THE Twenty-Seventh Session of the International Statistical Institute (the third after the Second World War), was held in Delhi from 5th to 11th and then in Calcutta from 16th to 18th of December. About 175 delegates from forty-two foreign countries and nine international organisations and a large number of Indian statisticians were brought together to discuss statistical problems in relation to Agriculture, Economics, Demography, Sociology and other Allied Sciences and Humanities.

Several international organizations affiliated to the International Statistical Institute, like the Biometric Society, the Econometric Society, the Association for Research in Income and Wealth and the International Union for the Scientific Study of Population also held special meetings jointly with the International Statistical Conference. The International Statistical Association for Asia and the Far East met in Calcutta and discussed the possibility of expanding their activities in the near future.

The Sampling Subcommittee of the United Nations also met in Calcutta immediately after

the conferences and discussed a number of problems arising out of large-scale sample surveys.

Among the major problems considered at the Conference were the development of national statistical systems in general, and in particular, of vital statistics, agriculture, population, labour statistics, education, and industrial statistics. The reports from various countries and organisations were read and critically examined by the experts. Besides these, there were about 153 contributed papers, many of which were taken up for discussion. There were also a number of papers on theoretical statistics.

Some of the special features of the Conference were field trips to villages near Delhi and Calcutta to study the sampling techniques followed in India for agricultural surveys and economic enquiries, visits to various statistical organisations and popular and semi-technical lectures by distinguished statisticians.

The Conference was followed by a number of seminar lectures which included addresses by Professors J. B. S. Haldane, R. A. Fisher and other distinguished persons. C. R. Rao.

PROBABLE REGIONS OF "JET" STREAMS IN THE UPPER AIR
OVER INDIA

P. R. KRISHNA RAO

(Regional Meteorological Centre, Madras)

FROM an examination of the normal meridional cross-sections of pressure, temperature and wind for every 20 degrees longitude over the Northern Hemisphere, Namias and Clapp¹ have given maps for January and July showing the average position and strength of the "jet" stream. These maps show a "jet" axis in January over North India at latitude 22°-25° N. while no such axis is shown over India in July. It appears possible from the normal upper wind pressure and temperature distribution over India to get an idea of the probable regions and heights where jet streams are likely to occur in the upper air over India.

Fig. 1 shows the normal distribution of temperature and the mean zonal west and east components of winds, determined from pilot balloon ascents, in the upper air over India along 78° E. in summer (monsoon) and winter. The temperature distribution is based on Indian Sounding Balloon data and the distribution of west and east components of winds have been

taken from Venkiteswaran's² diagrams with slight modification in respect of winds over South India above 16 km. on the basis of later data. The following conclusions can be drawn from an examination of this figure.

(a) In Summer (Monsoon).—(i) Between latitudes 5° N. and 18° N., easterly winds increase rapidly with height above 10 km., reach a maximum of 40 metres per second (88 m.p.h.) between 7° N. and 15° N. at 16-18 km., near the tropopause, and decrease with height above 18 km. Thus, there is a well-marked vertical wind shear in these latitudes (5° to 18° N.) above 10 km. but very little horizontal wind shear. (ii) Between the equator and 5° N. and between 18° N. and 27° N. there is, above 10 km., a well-marked horizontal wind shear but very little vertical wind shear. In these latitudes, the highest wind speed in summer is apparently not reached at the tropopause but at some different height.

(b) In Winter.—(iii) Between latitudes 10° N. and 18° N. there is a well-marked horizontal wind shear above 6 km. with westerly winds but very little vertical wind shear. In this latitude range also, the highest wind speed in winter is apparently not reached at the tropopause but at some different height. (iv) Between 18° N. and 30-35° N., there is both horizontal and vertical wind shear, with westerly winds. The vertical wind shear is most prominent and well marked between 22° N. and 32° N. above 10 km. The westerly winds increase in speed with height, reaching a maximum of 40 metres per second (88 m.p.h.) at a height of 12 to 14 km. between 25° and 30° N., and decrease with height above 14 km. It is thus seen that in these latitudes (25° to 30° N.) the maximum wind speed is reached at a height of 2 to 3 km. below the tropopause.

(c) Both in summer (monsoon) and winter, the regions in which there is marked vertical wind shear are separated by regions where there is marked horizontal wind shear. The marked horizontal wind shear is cyclonic to the north and anti-cyclonic to the south of the region of marked vertical wind shear.

3. As 'Jets' are narrow streams of air of small vertical extent, confined to a few degrees of latitude, with well-marked vertical wind shear with decrease of wind speed above and below them and with well-marked horizontal wind

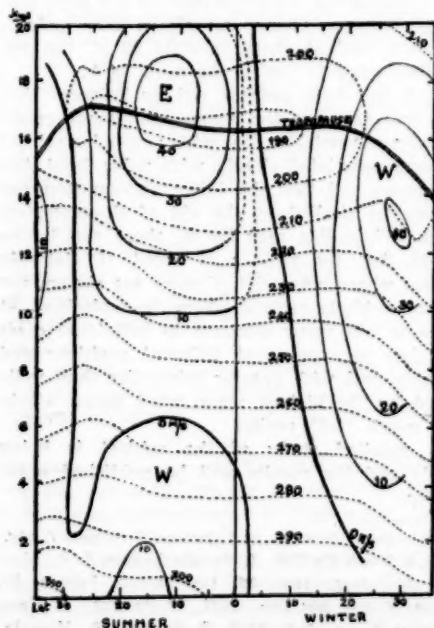


FIG. 1. East-West components of winds in m/sec. are shown by continuous lines and temperatures °K by dotted lines. Tropopause is shown by a double line.

shear to the north and south of them, it seems (para 2) that 'jet' streams are most likely to occur in the following regions over India.

(a) Between latitude 5° N. and 18° N. in the south-west monsoon season near about the tropopause (16 to 18 km.) and specially between 7° and 15° N., the 'jet' wind will be easterly. (b) Between latitude 22° and 32° N. in winter, at 12 to 14 km., specially between 25° and 30° N., the 'jet' wind will be westerly.

4. It is known that a 'jet' stream is associated with a concentration of horizontal temperature gradient below it and occurs in a field of pronounced baroclinity. Horizontal temperature gradients calculated from Indian Sounding Balloon data over different latitudes show that there is a concentration of positive horizontal temperature gradients (i.e., temperature increasing with latitude) below region (a) i.e., 5° to 18° N. in the summer (monsoon) and of negative horizontal temperature gradients below region (b), i.e., 22° to 32° N. in winter. This can also be seen from the slope of the isotherms in Fig. 1 which also indicate pronounced baroclinity in the regions (a) and (b).

5. It is seen further that region (b) covers the range of latitudes over which the transition from the tropical to the polar stratosphere occurs in winter. In this range of latitudes in winter, e.g., over Agra (Lat. 27° N.), the double type of tropopause is fairly frequent and there are also a number of occasions when the polar type of tropopause occurs there at a height of 11 to 12 km. It is also interesting to note that both regions (a) and (b) occur over latitudes where pressure is highest at the surface in the respective seasons. Palmen³ has shown that "the strongest west wind in the upper troposphere must be observed almost vertically above the sub-tropical high pressure belt, i.e., around latitude 30° ." This is found to be true over India and it is found further that the strongest east winds, in the summer (monsoon) near the tropopause, also occur vertically above the region of highest pressure at the surface over India.

6. While the existence of a westerly jet over the middle latitudes has been recognised and studied by various authors, notably by Palmen and co-workers, an easterly jet such as might occur in region (a) above near the tropopause has not so far been announced. In the meridional cross-section for summer along longitude 80° W. given by Hess⁴ and that for August-September over the tropical Atlantic given by Vuorela,⁵ concentration of easterly winds is shown just above the tropopause over the tropical latitudes. It is seen that over India a

region of strong easterly winds with the characteristics of a 'jet' exists near the tropopause over latitudes 7° to 15° N. All indications therefore point to the existence of an easterly jet at or near the tropopause in summer over the low tropical latitudes. Examination of some high pilot balloon ascent data on a number of consecutive days over stations in South India below latitude 15° N. points to the existence of an easterly jet at 16 to 18 km. on individual occasions. On some occasions, the easterly winds have reached speeds of 80 to 90 metres per second (175 to 200 miles per hour).

7. Chaudhury⁶ has discussed the existence of two westerly jets in winter over India near about the 200 mb. level (i.e., at about 12 km.), a "Himalayan Jet" at latitudes 30° to 35° N. and an "equatorial jet" at latitudes 15° to 20° N. The "Himalayan" jet occurs in region (a) above but the possibility of the "equatorial" westerly jet is not indicated by the normal wind, temperature and pressure distribution. It appears probable that Chaudhury's equatorial westerly jet is not a separate jet with marked vertical wind shear both above and below it, but is a concentration of westerly winds in the southern edge of the wind field of the 'Himalayan' Jet. Yeh⁷ discussing the circulation of the high troposphere over China in winter also finds a westerly 'jet' at about latitude 30° N. but not another westerly 'jet' to the south of it.

8. It has been pointed out by Palmen³ that the jets seen on the mean meridional cross-sections are not identical with "meandering" jet streams associated closely with polar front disturbances and that the latter phenomenon can hardly be studied by the aid of climatological data. While this may be so, there can be no doubt that the regions of about 10° latitude width, where mean 'jet' streams are shown, are the most likely regions where "meandering" jet streams will occur although in individual cases the jets may occur at different positions and heights, and with greater intensities than indicated by the highest mean wind speed within the mean "jet" region.

A detailed study of the subject is being made and the results will be published separately.

1. Jerome Namias and Jerome F. Clapp, *J. Met.*, 1949, 6, No. 5, Pp. 330.
2. Venkiteshwaran, S. P., *Mem. Ind. Met. Dept.*, 1950, 28, Part II.
3. Palmen, E., *Quart. J. Roy. Met. Soc.*, 1951, 77, Pp. 337.
4. Hess, Seymour, L., *J. Met.*, 1948, 5, Pp. 293.
5. Vuorela, Laouri, A., *Ibid.*, 1948, 55, 115.
6. Chaudhury, A. M., *Tellus*, 1950, 1, No. 1, Pp. 56.
7. Yeh, T. C., *Ibid.*, 1950, 2, No. 3, Pp. 173.

OPTICAL INSTRUMENTS*

IN the bewilderment caused by the recent advances in atomic physics and electronics, the scientist is apt to overlook the role of optics in modern scientific and industrial development. The important contributions made by optics to such development is brought home by these *Proceedings of the London Conference on Optical Instruments* held jointly with the International Optical Commission.

Photographic and projection lens manufacture, so important in aerial telephoto and wide-angle recording, received its due share of attention and a new zoom lens of variable focus has come into regular use. A new feature in the development of microscopy is the introduction of the reflecting microscope, which has a double advantage of greater achromatism and longer working distance. The ever-increasing demand of the biologist to study, not merely the structural outlines, but the detailed internal constitution of their objects of investigation, is met by the design of the phase-contrast microscope. In the ultra-violet region, the problem of imperfect achromatism is solved by the introduction of fused quartz-fluorite objectives which give virtual images, which are rendered real by their combination with spherical mirrors which are inherently achromatic.

In the field of spectroscopy, a new feature is the Echelle spectroscope whose performance lies intermediate between the *diffraction grating* and the *Michelson Echelon* in respect of resolution of spectral lines and concentration of light into one order. New types of mounting of gratings with additional mechanical and optical advantages are also designed. Spectrophotometry, which was till recently a laboratory technique for chemical analysis, has found important application in industry. Rapidity of

work combined with high accuracy of the results obtained, which are so important for industrial concerns, are both achieved by the latest types of spectrophotometer in which are incorporated compact and complicated optical, photoelectric and electronic assemblies, in addition to mechanical devices for automatic recording. The range of investigation is also extended far beyond the visible region into the infra-red and ultra-violet.

The problem of designing a coma-free astronomical reflector of large aperture and large field is now solved by the new Schmidt camera in which the aberrations of the spherical reflector are corrected by the introduction of a thin, nearly plane-parallel corrector plate placed in an aperture stop at the centre of curvature of the mirror. A new 98-inch telescope incorporating the latest optical and mechanical features is under erection at the new site of the Greenwich Observatory and the final results will be awaited with great interest. Reflecting telescopes are replacing the refractors in the smaller theodolites and binoculars also on account of their greater freedom from chromatism.

New types of testing equipment for determining transmissions of optical instruments are also discussed. Synthetic optical crystals and plastic glasses are new sources of raw material in optical technology which seem to open up new methods of scientific investigation.

The *Proceedings* which report the above developments in optical instrument designs, are thus of interest to the biologist, the astronomer, the spectroscopist and the industrialist. The discussions that followed each of the papers read, are highly illuminating as the contributors are all experts in their respective fields of optical research. All the topics dealt with are fully illustrated. The get-up of the book is good in respect of both arrangement of subjects and their general presentation.

I. RAMAKRISHNA RAO.

* *Proceedings of the London Conference, 1950.* (Published for the Organising Committee of the Conference, Chapman & Hall Ltd.) Pp. xv + 264. Price 42 sh.

WATUMULL ESSAY COMPETITION RESULTS

THE following are the prize-winners in the Essay Competition on "Population Control in Relation to Food in India": Dr. A. R. Mehta, Retired Deputy Director-General of Health Services, Government of India (Rs. 3,000); Dr. S. Ranganathan, Nutrition Research Laboratories, Coonoor (Rs. 1,000); Mrs. Kamalini Kulkarni, Poona (Rs. 500); and Dr. B. P. Ghosh, Calcutta (Rs. 200).

Six prizes of Rs. 100 each have been awarded to Mr. Pravakar Sen, Government College, Darjeeling; Nikhil Ranjan Banerjee, Cuttack, Orissa; Dr. Moreswar Patwardhan, District Belgaum, Bombay; Mr. Padmanabhan Nair, Farook College, Malabar; Anikendra Mahalanobis, Calcutta, and Arun Krishna Banerjee, New Delhi.

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THE COMPLEX BAND SPECTRUM OF NICKEL CHLORIDE

THE band spectrum of the diatomic molecule nickel chloride (NiCl) extending from 4,900-3,800 Å has been obtained using a heavy current discharge from a 2 K.W. D.C. generator. The general appearance of the bands is that of well separated close sequences. All the sequences reported by More¹ are observed. Among the four systems identified by More, the additional band heads newly recorded have led to a considerable extension of these systems. For systems 3 and 4, the observed additional sequences have led to the necessity of adopting a different assignment of O, O' heads and a renumbering of v', v'' values. Besides the four systems mentioned by More, four new ones have also been identified among the bands. For the eight systems recorded, the following vibrational constants have been obtained from the band head data.

System	ν_e	ω_e'	$\chi_e' \omega_e'$	ω_e''	$\chi_e'' \omega_e''$
1	22749.2	398.9	1.03	421.5	0.51
2	23230.7	398.0	0.25	415.9	0.35
3	23342.3	401.4	0.43	416.4	0.48
4	24224.6	400.7	0.60	416.1	0.40
5	21253.5	403.3	0.75	418.5	0.50
6	21756.7	402.9	0.30	421.1	0.89
7	21920.5	404.4	1.16	422.5	0.25
8	24336.5	401.1	0.52	416.4	0.27

The band systems show a complex intensity distribution; probably high multiplicity terms are involved in the electronic transitions.

A complete discussion and details of the analysis will be published elsewhere.

Dept. of Physics, V. G. KRISHNAMURTY.
Andhra University,
Waltair,
October 1, 1951.

¹ More, K. R., *Phys. Rev.* 1938. 54, 122

TERM VALUES IN THE F^k ELECTRON CONFIGURATION

ONLY last week we noticed a letter with the same title by V. Ramakrishna Rao,¹ who calculated the term values of the configuration f^k by the classical method of Slater² and found some discrepancies with our previous results.³

The main source of these discrepancies seems to be a misinterpretation of the Tables of Condon and Shortley:⁴ the quantities a^k and b^k defined by Slater are always fractions for $k > 0$, but it was found convenient by Condon and Shortley to treat them as integers by associating the common denominator of several related values with the corresponding F or G. For this reason the common denominator is printed but once at the beginning of each group; but it is understood that it should be maintained for the whole group if Slater's F^k are used, and it should be cancelled for the whole group if the new $F_k = F^k/D_k$ are used.

The example of 2L given by Rao shows that he maintained the denominators for the coefficients of the first row, and only for them. By cancelling the denominators in Rao's Table, and also correcting some obviously misprinted signs in both sides of the Table, almost all the discrepancies are eliminated.

The remaining difference of $-200 F_6$ in 4D seems to be due to an error of summation, and causes an error of $+200 F_6$ in his value of 4S . We were unable to guess the source of the error in the calculation of (2D); but our value seems to be correct, as it is checked also by an independent calculation.⁵

As for the "discussion" of the "discrepancies", we do not see any reason, why 4F and 4S could not have equal energies in this approximation; similar cases are already known in the literature, as 2P and 2H in the d^3 configuration⁴ and 2S and 4S in the d^2p configuration.⁵ The empirical law that terms with lesser L should be higher holds only in a few simple configurations and does not hold at all in f^k , where 4F and 4S are lower than 4G and 4D .

The Hebrew University,
Jerusalem,
Israel,
January 11, 1952.

GIULIO RACAH.

KAEMMERERITE FROM KONDAPALLE KISTNA DISTRICT

Deposits of chromite occur in the Kondapalle range of hills, Kistna District, in association with ultra-basic charnockites and are being worked for over ten years now. A detailed investigation of the area which is in progress has revealed the occurrence of k  mmererite, the chrome-bearing variety of chlorite, in association with the ore bodies. The mineral is seen inside and alongside the bands of serpentine and pale yellow-green serpentinised pyroxene which generally surround the lenses and lentils of chromite. Further, it is sparsely distributed in the veinlets of serpentine that traverse the ore. It is red or purple in colour, and has a distinct flaky habit occurring mostly as small thin spangles, sometimes along with biotite.

Under the microscope, the mineral appears in the form of thin flakes, deeply coloured owing to high dispersion, the phenomenon resembling the twinkling in calcite. It is seen close to masses of serpentine and has opaque or nearly opaque chromite moulded on it. A few flakes show bent cleavages also. Its microscopic characters as determined with Federov's Universal Stage are as follows:

Optically negative; biaxial with very low optic axial angle (2V) ranging from 15° to $2.5^\circ \pm 0.5^\circ$, tending to be almost uniaxial; pleochroism X: Pale red purple; Y = Z: Pale reddish yellow; X direction normal to (001); birefringence (as measured with Berek's Compensator) 0.004.

Winchell^{1,2} is of the opinion that when chromium enters chlorite in any significant amount, it imparts a violet or lavender colour to the mineral which assumes an optically negative character. However, he mentions also an optically positive variety from Sweden. Similar variation in optical character has also been referred to by Dana.³ The mode of occurrence and characteristic association of the mineral with chromite and serpentine of Shetland Islands has been outlined by Phillips⁴ and similar association with chrome ore has been reported by others at various points in North Carolina. In India the mineral has so far been reported only from Mysore by Naidu⁵ and by Viswanathiah.⁶

The present occurrence of k  mmererite in association with serpentine and chrome ore is significant in that it speaks of the activity of hydrothermal solutions in the formation of the species of chlorite under consideration as also of some chromite, a conclusion reached earlier

1. Rao, V. R., *Curr. Sci.*, 1950, 19, 8. 2. Slater, J. C., *Phys. Rev.*, 1929, 34, 1293. 3. Racah, G., *Ibid.*, 1942, 62, 438. 4. Condon, E. U. and Shortley, G. H., *Ibid.*, 1931, 37, 1025. 5. Racah, G., *Ibid.*, 1949, 76, 1352.

by the author⁷ with regard to the genesis of the ore of the area.

Further work on the material is in progress and a detailed paper will be published elsewhere.

Dept. of Geology,
Andhra University,
Waltair,
February 4, 1952.

M. SRIRAMA RAO.

1. *Amer. Mineral.*, 1936, **21**, 642. 2. *Elements of Optical Mineralogy*, Part II, 3rd Edition, John Wiley & Sons, 1946, 286. 3. *Text-Book of Mineralogy*, 4th Edition, John Wiley & Sons, 1947, 670. 4. *Quart. Jour. Geol. Soc. Lond.*, 1927, **83**, 622. 5. *Proc. 30th Ind. Sci. Cong. Abstracts*, 1943, **39**. 6. *Curr. Sci.*, 1951, **20**, 15. 7. *Proc. Ind. Acad. Sci.*, 1947, **26**, 133.

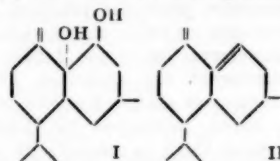
SESQUITERPENES FROM PIPER CUBEBA, LINN.

THE sesquiterpene hydrocarbon fraction ($C_{15}H_{24}$), b.p. $111-112^\circ/9$ mm. d_4^{25} 0.8894, n_D^{25} 1.4859, n_D^{20} 1.4850, n_D^{15} 1.4850, n_D^{10} 1.4850, M.R. 65-95, unsaturation value 1.45, isolated from the essential oil from *Piper cubeba*, Linn., is not cadinene, as reported by Simonsen¹ and co-workers, but a mixture of the tricyclic hydrocarbon copæne (responsible for the formation of cadinene dihydrochloride) with another new hydrocarbon possessing two conjugated double bonds, as indicated by (i) reduction with sodium and alcohol, (ii) adduct with maleic anhydride (M.P. $125-127^\circ$ C.), and (iii) red colour with diazotised p-nitroaniline (Fieser's test).²

Ozonolysis, along with other products, gives formaldehyde, formic acid and copæne carboxylic acid³ (semicarbarone, m.p. 222°). The presence of copæne has been confirmed by the labelling method of Ruzicka and Sternbach^{4,5} and isolation of 7-methyl cadalene. As copæne does not contain any exocyclic double bond, the formaldehyde formed during ozonolysis must be coming from the new conjugated hydrocarbon. The latter, therefore, must possess an exocyclic double bond.

Like other conjugated compounds,⁶⁻¹⁰ this new hydrocarbon forms a normal oxide with percamphoric acid, but with perbenzoic acid it forms a hydroxy-monobenzoate, which on alkaline hydrolysis produces a α -glycol. The glycol gives cadalene on dehydrogenation and formaldehyde on ozonolysis. Specific oxidation test with lead tetra-acetate and potassium periodate^{11,12} shows that at least

one of the hydroxyl groups is secondary. The glycol undergoes almost spontaneous dehydration in a slightly acidic medium giving rise to a hydrocarbon. Taking all these facts into consideration, the most likely formula for the glycol is (I) and that for the hydrocarbon is II.



The authors are thankful to Prof. P. C. Guha and Dr. Sukhdev for their kind interest during the course of this investigation.

R. K. RAZDAN.*

S. C. BHATTACHARYYA.†

Organic Chemistry Labs.,
Ind. Inst. of Science,
Bangalore 3,
October 16, 1951.

1. Rao Shintre and Simonsen, *J. Soc. Chem. Ind.*, 1928, 47, 92-97. 2. Fieser and Campbell, *J. Amer. Chem. Soc.*, 1938, **60**, 168. 3. Semmler and Stenzel, *Ber.*, 1914, **47B**, 2557. 4. Ruzicka and Sternbach, *Helv. Chim. Acta*, 1940, **23**, 124. 5. Briggs and Taylor, *J. Chem. Soc.*, 1947, 1338. 6. Windaus and Luttinghaus, *Ann.*, 1930, **481**, 110. 7. Fieser and Fieser, *Natural Products Related to Phenanthrene*, 1949, 3rd edition, p. 225-27. 8. Bengmann and Skan, *J. Org. Chem.*, 1950, **5**, 439-42. 9. Bradshos, *J. Amer. Chem. Soc.*, 1944, **66**, 45-46. 10. Newbold and Spring, *J.C.S.*, 1945, 247. 11. Criegee, *Ber.*, 1931, **64**, 260. 12. Schriener and Fuson, *The Systematic Identification of Organic Compounds*, 3rd edition, p. 115.

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National Chemical Laboratory,

FATTY OIL FROM THE SEEDS OF OCIMUM SANCTUM LINN. (TULSI)

On extraction with ether, the crushed seeds, obtained from plants grown on the premises, yielded a greenish yellow fatty oil 17.82%. It has the following properties: Specific Gravity (30° C.), 0.9063; N_D^{20} 1.4789; Acid Value, 2.02; Saponification Value, 181.65; Iodine Value, 173.0; Thiocyanogen Value, 104.6; Acetyl Value, 12.11; R. M. Value, 1.2; Polenske Value, 0.2; Hehner Value, 93.56; Unsaponifiable Matter, 2.32.

The composition of the fatty acid is as follows: Palmitic, 6.9%; Stearic, 2.1%; Linolenic, 15.7%; Linoleic, 66.1%; Oleic, 9.0%. The unsaponifiable matter yielded a small quantity of sitosterol.

On direct bromination of the oil in dry ether, insoluble bromoglycerides were crystallised out. Three bromoglycerides were isolated—two dilinolenolins melting at 157°C. and 145°C. respectively and a linolenodilinolin melting at 80°C. The *Ocimum sanctum* seed oil showed good drying properties. A few drops of the oil spread into a thin film on a glass plate dried within 4 days into a tough film.

Details will be published elsewhere.

Chemistry Department, G. B. NADKARNI.
Willingdon College, V. A. PATWARDHAN.
Sangli,
January 17, 1952.

AN ANTIDIABETIC PRINCIPLE FROM *RIVEA CUNEATA* (WRIGHT)

CLINICAL trials showed that oral administration of a milk extract of the leaves of *Rivea cuneata* for 3-5 days brings about a significant remission of the characteristic symptoms of diabetes. It was, therefore, of interest to investigate the antibiotic principle associated with the leaf.

Extraction of the leaves of *Rivea cuneata* with alcohol yield a concentrate containing an active principle which has a significant effect on alloxan diabetes in rats. The active principle has been identified as a glycoside. It is soluble in water and alcohol, but insoluble in other organic solvents. On acid hydrolysis, it yields a reducing sugar glucose, and a water insoluble aglucone, which gives the colour reaction characteristic of steroids.

Pharmacological experiments in dogs show that the glycosides given in large doses, 0.3 g./kg. body weight lowers the blood pressure. Toxicity tests on mice showed that it is non-toxic even in large doses, 1.0 g./kg. body weight.

The glycoside when administered orally has little effect on fasting blood sugar level in man, rabbit and rats. When given subcutaneously, the glycoside has no effect on the blood sugar level in rabbits.

The effect of the glycoside on experimental alloxan diabetes in albino rats was very encouraging. The glycoside was given orally to rats in daily doses of 5 mg. dissolved in water; after 8 days, they received subcutaneous injections of 200 mg./kg. of alloxan. At the end of 25 days, all the rats in the treated group had

normal blood sugar and no sugar in urine. Mortality was 20 per cent. as compared with 60 per cent. in the control group. Further observations showed that treated rats had relapses after 30-40 days. A second course of treatment was beneficial only in 10 per cent. of these rats.

Post-mortem examination of pancreas in normal rats receiving the glycoside orally for 30 days and killed 30 days after treatment, showed evidence of hyperplasia and hypertrophy of the islets of Langerhans. Other organs appeared normal.

Our grateful thanks are due to the Indian Council of Medical Research for the grant of a Fellowship to one of us (M. R. R. R.) and to the Director of the Indian Institute of Science, Bangalore, and the Director of the Central Drug Research Institute, Lucknow, for their keen interest. Our thanks are also due to Dr. K. P. Menon for his kind interest in the work.

Central Drug M. R. RAJA RAMA RAO.
Research Institute, N. N. DE.
Lucknow.

1. Hooker, *Flora of British India* London., 1897, 4, 101

CONTROL OF FUNGAL GROWTH BY EARTHWORMS

ONE of the difficulties experienced in the course of breeding *T. deliensis* (Walch) in the laboratory by several workers^{1,2,3} is the growth of fungal mycelia in the rearing tubes. Attempts to control fungal growth through the use of copper sulphate solution² or by the addition of lime¹ to the breeding tubes have met with only partial success. In the course of this work, it was observed that in one of the breeding tubes that had been prepared with a fresh batch of Hooghly river sand, there were a few small earthworms and in this tube alone, there was no fungus growth and the breeding of mites was satisfactory. We have since fully convinced ourselves that these earthworms are mainly responsible for keeping down fungal growth.

Although originally the earthworms came from the river sand, search of the garden soil in the Institute revealed that similar earthworms were present there also. These worms are translucent white in colour and seldom exceed 2" in length, when fully grown. They have been identified as a species of *Enchytraeus* (Fam. Enchytraeidae: Oligochaeta). They breed freely in the mite-rearing tubes and when their number becomes excessive, the surplus is transferred

to 'stock-pots' leaving only a few in the rearing tubes. The stock-pots are ordinary tubes with about an inch of moist sand at the bottom; mosquito eggs, decaying leaves, rotting filter-paper and other similar substances are put in, to provide food for the worms. Transferring the worms from the stockpot to the rearing tubes or vice versa is not difficult, as they always show a tendency to collect around a clump of mosquito eggs or a piece of filter-paper. This clump of eggs with the worms round it, can then be picked up easily and transferred to any breeding tube as required.

The authors wish to thank Dr. K. V. Krishnan, for facilities provided for this work, and to Dr. K. N. Bahl, for kindly identifying the earthworms.

All-India Inst. of Hyg. & Pub. Health,
Calcutta,
February 22, 1952.

R. O. A. SMITH.
M. G. RAJA VARMA.
K. P. BHATTACHARYA.

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CHROMOSOME NUMBER IN SOME MEMBERS OF APOCYNACEAE AND LYTHRACEAE

THE chromosome numbers of the following species have been determined and as far as the authors are aware they have not been reported by any workers previously.

LYTHRACEAE	n	2n
<i>Lagerstrœmia indica</i>	.. 24	
<i>Lagerstrœmia Flos-Reginae</i>	.. 24	
<i>Lagerstrœmia Thorelli</i>	.. 24	
<i>Woodfordia floribunda</i>	.. 8	
APOCYNACEAE		
<i>Allamanda grandiflora</i>	.. 9	18
<i>Allamanda violacea</i>	.. 18	36
<i>Tabernaemontana dichotoma</i>	.. 11	22
<i>Tabernaemontana coronaria</i>		33

Bhupendra Singh¹ has reported the chromosome numbers of three species of *Plumaria*, viz., *P. alba*, *P. rubra* and *P. acutifolia*. Of these he has reported the somatic and gametic numbers of the first and the gametic numbers only of the remaining two species. Our investigations of the same three species of *Plumaria* confirm the *n* and *2n* determinations of Bhupendra Singh. Further the *2n* number, 36 of *P. rubra*

and *P. acutifolia* determined by us accords with *n* = 18 previously determined by Bhupendra Singh.

In the genera *Allamanda* and *Tabernaemontana* polyploidy is observed with *A. grandiflora* representing a diploid and *A. violacea* a tetraploid. *T. dichotoma* has a diploid number of 22 compared to the triploid number of 33 of *T. coronaria* reported above. Phatak and Tiwari² report of a diploid type of *T. coronaria* with *2n* = 22, which with the number reported above shows the existence of polyploidy within this species.

In the above species of *Allamanda* and *Tabernaemontana* examined, multivalent association of chromosomes were frequently observed.

The counts of somatic and gametic numbers were made from permanent mounts of paraffin embedded material.

Botanical Laboratory,
College of Agriculture,
Poona 5,
October 27, 1951.

L. S. S. KUMAR.
J. A. VASAVADA.
S. P. BHAGAT.

1. Bhupendra Singh, *Curr. Sci.*, 1951, **20** (4), 105. 2. Phatak, G. W., *et al.*, *Curr. Sci.*, 1949, **18**, (9), 347.

ACTINOMYCETES ANTIBIOTIC TO PLANT-PATHOGENIC BACTERIA

DURING the course of a study of some actinomycetes isolated from Karnataka soils it was thought worthwhile to determine whether any of the cultures under study were antibiotic to plant-pathogenic bacteria that occur in India. In all, 64 cultures of actinomycetes (as yet not identified) were tested against 20 species of plant-pathogenic bacteria belonging to the genus *Xanthomonas*. Members of this genus are Gram negative rods, motile by a single polar flagellum, and produce a yellow pigment.

The tests for antibiosis were carried out on a modified Czapek's medium containing peptone, using a standard technique; this medium was selected, from amongst a large number tried, as it supported good growth of both the test organisms and the bacteria. Inoculations were made with a straight needle from cultures on Czapek's agar slants. Incubation was done at 30° C.

The results were recorded after 48 hours' incubation in most cases by measuring the zones of inhibition around colonies of the test organisms. However, some of the plant-pathogenic bacteria grew slowly and in such cases results

were taken when the bacteria had fully grown and covered the plates.

Of the 20 species of *Xanthomonas* tested, *X. cassiae* and *X. begoniae* were not inhibited by any of the actinomycetes, whereas the rest of the species were inhibited by one or more cultures of the actinomycetes.

From the 64 cultures of actinomycetes under study, only 7 proved antibiotic to 3 or more species of the bacteria tested. The results obtained with these 7 cultures are recorded in the accompanying Table.

Species of <i>Xanthomonas</i>	Zone of inhibition (dia. in mm.) produced by actinomycetes: Culture Nos.						
	5	20	23	33	39	45	48
<i>X. campestris</i>	30	15	C	C	C
<i>X. citri</i>	7
<i>X. malvacearum</i>	..	C	20	..	C	C	25
<i>X. sojense</i>	25	..	..	7	7
<i>X. desmodii</i>	10	..	..	7
<i>X. desmodii-gangetici</i>	..	17	25	17	17	10	15
<i>X. vignicola</i>	45	17	12	30	..
<i>X. upsalii</i>	..	20	15	12	10	10	..
<i>X. vesicatoria</i>	..	55	40	35	30	..	30
<i>X. alfalfae</i>	..	12	..	..	..	15	12
<i>X. badri</i>	..	20	..	..	..	..	..
<i>P. bellicola</i>	..	20	..	..	..	..	..
<i>X. cassiae</i>
<i>X. ricinicola</i>	..	25	15	..	25	15	20
<i>X. begoniae</i>
<i>X. stilzobicola</i>	..	30	..	..	..	..	..
<i>X. lawsoniae</i>	..	20	..	..	..	..	..
<i>X. tamarindi</i>	..	30	..	..	..	..	..
<i>X. poinsettiae</i>	..	5	..	..	..	..	10
<i>X. caryani</i>	..	30	..	..	15	..	10

Note. — C = complete inhibition; zone too large to be measured.

Further work using filtrates of the promising actinomycetes cultures on Czapek's medium is in progress. In similar experiments with plant-pathogenic fungi of the soil, some of the cultures have given promising results against *Sclerotium rolfsii*. The morphological and biochemical characters of the actinomycetes are also being studied with a view to ascertaining their identity.

The authors are grateful to the Plant Pathologist to Government, B.S., Poona, for supplying cultures of *Xanthomonas* species.

Bacteriology Section,
College of Agriculture,
Dharwar,
November 8, 1951.

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L. MONIZ.
R. B. PATIL.

BLOSSOM BLIGHT OF DAHLIA

The blight of Dahlia flowers was observed at Nagpur, during the period of high humidity in the atmosphere in August and September, 1950.

The disease starts as a minute water-soaked spot on the succulent corolla. These spots soon enlarge causing a soft-rot and shedding of a majority of petals. The affected tissues are discoloured brown to black. The infection may also advance to the sepals and the floral stalk. Soon after, a luxuriant crop of silvery white conidiophores and deep brown to black heads of conidia and sporangia appear on the affected tissues of the blossom. The mycelium of the organism is found traversing the tissues of the affected parts.

The organism produces a luxuriant cottony aerial growth of aseptate mycelium and grows rapidly at a room temperature (28-30° C.) on rice meal-agar.

The conidia and conidiophores are produced on the host as well as in the culture. On the host the conidiophores are erect, continuous and unbranched. They are white at first and metallic silvery when ripe. The conidiophores end in a capitate vesicle from which numerous short-stalked globular to pyriform cells arise. These cells produce a number of short sterigmata each of which bears a single conidium at the apex. After the release of the conidia the globular or pyriform cells collapse resulting in the funnel-shaped structures still attached to the primary capitate vesicle.

The conidia are single-celled, dark-brown in colour, globular or elliptical or obovate in shape with a distinct scar at the point of attachment. They are finely spinulose and measure $7.5-23.7 \times 6.7-14.4 \mu$ (average $15.1 \times 10.7 \mu$).

The sporangia are produced both on the host and in the cultures. They have a thin wall which soon ruptures to liberate the brown sporangiospores leaving a large round columella and the remnants of the sporangial wall. The sporangia produced on the host are 27μ in diameter while those produced in the culture vary from $30.0-48.0 \times 30.0-60.0 \mu$ (average $39.1 \times 43.3 \mu$).

The sporangiospores are globose, elliptical or triangular in shape, dark-brown in colour and measure $7.3-18.6 \times 4.4-13.6 \mu$ (average $13.8 \times 9.3 \mu$), more or less equal to the conidia in size.

The zygospores produced in cultures, are dark-brown to chocolate in colour, almost globular in shape with a thick smooth epispore. They are $36.6-60.9 \mu$ (average 50.1μ) in diameter.

The morphology and the cultural characters of the fungus correspond to those of *Choanephora infundibulifera* (Currey) Cunningham. Burger (1924) reported from Florida, a similar disease of Dahlia caused by an unidentified species of *Choanephora*.

When the spore-suspension of the organism was sprayed on fresh Dahlia flowers the infection was observed within 24 hours and the typical blight appeared. The pathogen was reisolated. The flowers in controlled series remained all healthy.

Thanks are due to Dr. R. P. Asthana, Mycologist to Government, Madhya Pradesh, for facilities accorded for the work.

Agri. Research Institute, ABIR CHANDRA JAIN.
Nagpur, K. G. NEMA.
January 9, 1952.

1. Burger, O. F., *Rept. Plant Pathologist—Rept. Florid. Agric. Exp. Stat.*, for the fiscal year ending June 30, 1924, 84 R-113 R, 1924.

AN EXCEPTIONAL GYNÆCEUM OF *CITRUS MEDICA* VAR. *LIMON* L. SHOWING ADHERENT POLLEN CHAMBERS AND EXTRA-OVARIAN OVULES

WHILE dissecting out a flower of *Citrus medica* var. *Limon* it was found that the gynæceum was peculiar in having some anther lobes adhering to the ovary and style. Another interesting feature revealed by microscopic study was the presence of ovules on the outer surface of the ovary wall.

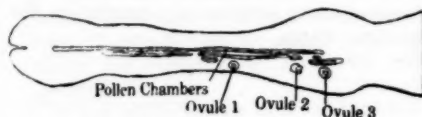
The gynæceum, which was about 9 mm. long and 1.4 mm. wide, was fixed and sectioned transversely for detailed study.

The ovary was elliptical at its base with certain insignificant undulations and contained prominent oil glands in its peripheral region. The ovary was 8-locular, with axile placentation and two rows of ovules in each locule.

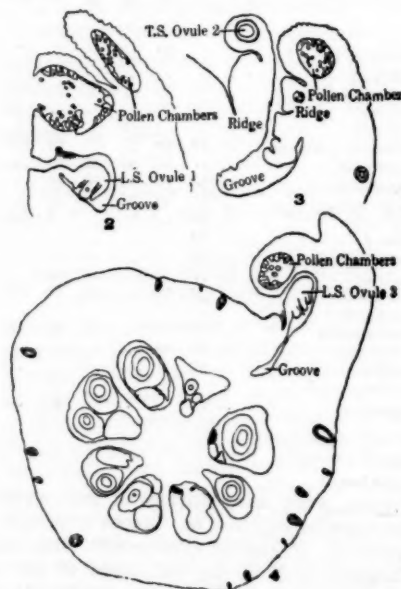
A study of serial transverse sections showed that the gynæceum had a groove running along its entire length, the groove itself being accompanied by a longitudinal ridge on each side. The edges of the two ridges were curved towards each other so that the groove appeared like a canal. The edges of the ridges, however, remained sufficiently apart to leave a long slit-like opening along the entire length except when approaching the stigma. Here the ridges fused producing a closed chamber which looked like

the continuation of the ovarian chambers seen in that region.

Along one of the ridges 7 pollen chambers were present, of which one ran longitudinally almost from the base of the ovary to the stigma. Four, situated one above the other, formed a second line parallel to the first and the remaining two lay adjacent to the second line, one near the bottom, the other near the middle (Fig. 1).



The pollen chambers were in different stages of development, some showing intact tapetum



FIGS. 1-4. *Citrus medica* var. *limon* L. Fig. 1. Reconstruction of the gynæceum from T. sections showing adherent pollen chambers and extra-ovarian ovules $\times 25$. Fig. 2. T. S. gynæceum showing the groove, the extra-ovarian ovule 1 and dehiscent P. chamber. $\times 60$. Fig. 3. T. S. gynæceum through extra-ovarian ovule 2. $\times 60$. Fig. 4. T. S. entire ovary showing extra-ovarian ovule 3. $\times 50$.

and tetrads enclosed within the wall of the pollen mother-cell, others with fully developed

pollen grains and tapetum disorganised. One chamber had dehiscence, but all the pollen grains had not escaped from the pollen chamber (Fig. 2). The pollen grains examined had one nucleus and three germ pores.

The other ridge bore three ovules situated one above the other and the latter showed an early stage of development. The lowest ovule, seen in longitudinal section, was directed towards the depression in the ovary wall (Fig. 4). The second one, seen in transverse section, was directed outwards and was quite exposed (Fig. 3). The uppermost ovule was borne on the ridge in the styler region and seen in longitudinal section (Fig. 2). These ovules were bitegmic. Stages in the development of the embryo-sac could not be studied due to degeneration. The extra-ovarian ovules did not differ structurally from those present in their normal position.

Although adhesion of anthers to gynæceum is a regular feature in certain plants, the present case is to be regarded as a teratological phenomenon because it is not usually found in plants of the family Rutaceæ. A somewhat similar case has recently been reported in *Zephyranthes roseum* Lindl. (Amaryllidaceæ).

The presence of naked ovules outside the ovary is specially noteworthy (Fig. 3). It might be explained by supposing that a chamber had been displaced outwards and its outer wall did not develop properly.

I am grateful to Mr. Reayat Khan, who gave me the material and helped me in writing the account.

Department of Botany,
Muslim University,
Aligarh,
November 11, 1951.

MOHD. FAROOQ.

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5. Kachroo, P., *Curr. Sci.*, 1930, 19, 325.
6. Raunkiaer, C., *Sc. Bot. Tidskr.*, 1914, 33, 379.

PINNASPIS SP.—NEW COCCID PEST ON CORCHORUS CAPSULARIS LINN. (JUTE)

FERRIS AND RAO¹ have revised the genus *Pinnaspis*, previously described under different names since 1892 and in their opinion, its centre of origin lies in India and Ceylon. Further information is, therefore, likely to be obtainable

only from this region and a species of *Pinnaspis* recorded on *Corchorus capsularis* Linn. furnishes information hitherto unrecorded.

The pest was collected and multiplied under laboratory conditions for further observation. The young nymphs after hatching move about for about 30-40 hours to fix themselves for the rest of their lives to the host plant and draw their nourishment therefrom. During the first instar, curly waxy fibres are secreted by both male and female nymphs; morphological differentiation of sex begins on the 4th or 5th day with the development of scales; males developing white tricarinate scales, and females secreting elliptical brown scales with broadened ends. Females are apterous throughout their lives and cannot move, once they are fixed. Delicate two-winged males emerge out from the carinated scales.



FIG. 1. Photomicrograph of *Pinnaspis* sp., female × 55.

Derm of the adult female (Fig. 1) is membranous with a weakly developed sclerotinised pygidium. Two or three notched median pygidial lobes are closely united at the base by a median sclerosis with their distal mesial margins fused or very slightly separated. Anal orifice is situated near or slightly anterior to the centre of pygidium. Preanal scars are distinct and are crescentic in shape. Perivulvar pores are arranged in five groups around the anal orifice. Two-barred ducts and gland spines are prominent. These are some of the important characters which place the present material near the species *strachani* under genus *Pinnaspis*.

The presence of a short parallel-sided mesial lobule of the second pygidial lobe suggests that the present species is nearer to the *townsendi* type of *P. strachani* than to the typical

strachani of Cooley. But the presence of a greater number of minute ducts (3-10) in each cluster of the submedian series places it nearer to the typical *strachani* than to the *townsendi* type, where each cluster contains 2-3 ducts, which are large as submarginal macroducts.

The present material again differs from both the other types in the arrangement of macroducts in the 3rd-5th abdominal segments (Table I).

TABLE I

Type		SEGMENT		
		3rd	4th	5th
<i>P. strachani</i>	..	3-5	3-5	1-3
<i>Pinnaspis</i> sp. (present material)	..	5-21	5-15	6-16

Two other important fibre crops, viz., *Hibiscus sabdariffa* var. *altissima* Hort. and *H. cannabinus* Linn. have been recorded as alternate hosts, though *Corchorus olitorius* Linn. (sweet jute) has been found to be resistant to this species.

Thanks are due to Dr. W. J. Hall, Director, Commonwealth Institute of Entomology, London, for kindly identifying the material as *Pinnaspis* sp. near *strachani* Cooley and also to Dr. B. C. Kundu, Director, Jute Agricultural Research Institute, for his keen interest in the work.

Jute Agri. Res. Institute,
Barrackpore,
W. Bengal,
January 9, 1952.

N. DUTT.

I. Ferris, G. F. and Rao, V. P., "The genus *Pinnaspis* Cockerell (Homoptera, Coccidae, Diaspididae)," *Micro-entomology*, 1947, 12, Part 2, 25-58.

TWO NEW BACTERIAL DISEASES OF PLANTS

A BACTERIAL leaf-spot on *Clerodendron phlomoides*, a tall pubescent shrub growing by the side of railway lines was noticed for the first time at Kirkee in 1949. The shrub is common in many parts of India, principally in the drier regions of the Punjab, the Deccan, Bihar, Oudh, Madhya Pradesh, Gujarat and also Ceylon. Besides its use as a bitter tonic, its leaves are relished by cattle, especially the goat.

On the leaves, the pathogen produces round to irregular water-soaked spots on the lower surface. In advanced stages of infection, the spots become irregular in shape and often coalesce forming large angular lesions measuring 4 mm. The corresponding areas on the upper surface become brown to dark brown. Often, the spots have a thin parched centre and cause slight leaf crinkling. Bacterial ooze in the form of small, pearly beads appear on the lower surface of the leaves. The pathogen infects veins and the leaf edges.

Description of the Pathogen.—Short rods; single or in chains; $1.1 \times 0.5 \mu$; gram negative; capsulated; no spores; on potato dextrose agar, the colonies are circular with entire margins, measuring 1.8 cm. in diameter after 7 days; colour pale lemon yellow (R); gelatin liquefied; starch hydrolysed; casein digested; milk peptonised; litmus reduced; ammonia and hydrogen sulphide produced; nitrates not reduced; acid but no gas from dextrose, sucrose and lactose; no growth in salicin; optimum temperature for growth about 31°C ; thermal death point near 51°C ; pathogenic on *Clerodendron phlomoides* L.

Since the organism is new to science, it is proposed to name it *Xanthomonas clerodendroni* nov. sp.

(2) On the Agricultural College Farm, Poona, in 1949, a new bacterial disease was noticed on *Sesbania aegyptiaca*, a shrub used as fodder, windbreak and supports in betel leaf and grape gardens.

On the leaves, the disease appears as small, round, water-soaked spots 0.5 to 1 mm. surrounded by halo measuring about 1.5 to 2 mm. in diameter. On the upper surface of the leaves, the corresponding areas become chlorotic. The centre of the spot turns brown whereas the surrounding area turns yellow. As a result of severe infection, the entire leaflet becomes chlorotic and ultimately sheds. Infection of the tender stem is found in the form of vertical greyish streaks measuring about 4 mm. in length. On the rachis of the leaf, infection takes place in the form of long vertical greyish lesions upto 3 mm. in length. The centre of such lesions often cracks oozing minute, pearly, bacterial gummy beads. The pathogen infects leaf edges also.

Description of the Pathogen.—Small rods; single or in chains; $1.3 \times 0.7 \mu$; gram negative; capsulated; no spores; on potato dextrose agar, the colonies are circular with striations starting 5 mm. away from the centre, and coming

upto the periphery; colour barium yellow (R); diameter 2 cm. in 7 days; gelatin liquefied; starch hydrolysed; casein digested; milk slightly peptonised; litmus slowly reduced; ammonia and hydrogen sulphide produced; nitrates not reduced; acid but no gas from dextrose, sucrose and lactose; no growth in salicin; optimum temperature for growth 31° C.; thermal death point about 51° C., pathogenic on *Sesbania ægyptiaca* Poir.

Since no bacterial disease has been reported on *Sesbania ægyptiaca*, it is proposed to name it *Xanthomonas sesbaniae* nov. sp.

Fuller details will be published elsewhere.

Plant Pathological Lab., M. K. PATEL.
College of Agriculture, Y. S. KULKARNI.
Poona, G. W. DHANDE.
January 15, 1952.

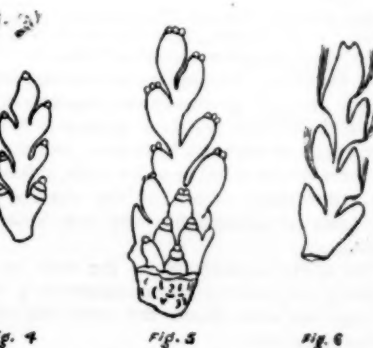
NODAL BUDS OF NARENGA PORPHYROCOMA (HANCE) BOR.

The genus *Narenga* Bor. consisting of a single known species *N. porphyrocoma* (Hance) Bor. was formerly under the genus *Saccharum* L. as *S. narenga* Wall. but has recently been given generic rank. Unlike in the species of *Saccharum*, only flowering culms are noticed in *N. porphyrocoma* and the nodes have buds but no root eyes.

In one of the experiments at the Physiology Section, a short axillary panicle of about two inches was found to have developed at the top node of a flowered culm of *N. porphyrocoma*. This unnatural development attracted attention and led to the examination of the lower buds as also those in a number of flowering culms. It was noticed that the buds at the nodes were floral and not vegetative as was supposed to be. This was a characteristic of the species.

The flowering culm usually has five nodes of which the top most, next to the rachis, is devoid of bud. In culms of the same age, the development of the floral buds followed a regular and successive stage of development from bottom to top. In a culm wherein the panicle is in full bloom and anthesis in progress, the dissection of the bottom bud reveals a long thin meristem with two ranks of lateral ridges (Fig. 1). In the next upper node, the two rows of alternating ridges are more pronounced, each ridge embracing more than half the circumference (Fig. 2), while in the third and fourth nodes, the buds show differentiation into rudimentary spikelets (Figs. 3 & 4). In more advanced culms,

wherein the anthesis is over and the spikelets start drying up, the bud at the bottom node shows directly the stage in Fig. 3 and the other



three buds higher up, the stages as in Figs. 4, 5 & 6. The last-mentioned is an advanced stage with differentiation of glumes and callus hairs.

This is the first report of the occurrence of floral buds at the nodes in the tribe *Andropogoneae* and indicates a close relationship between the two tribes *Andropogoneae* and *Maydeae* with *N. porphyrocoma* forming a connecting link between the two tribes.

Sugarcane Breeding Inst., M. VIJAYASARADHY.
Coimbatore, J. THULJARAM RAO.
January 18, 1952. R. NARASIMHAN.

AUTOTRIPLOIDY IN GUAVA (*PSIDIUM* *GUAJAVA*, LINN.)

AMONG the seeded varieties of guava 'Lucknow 49' has a somatic complement of 22 chromosomes (Fig. 1). The meiotic behaviour of its chromosomes is regular. Janaki Ammal² and Atchison¹ have reported the chromosome number of guava as $2n=22$, which tallies with the chromosome number of the seeded variety 'Lucknow 49'.

A seedless variety* from a collection examined by us has a somatic complement of 33 chromosomes as determined from the vegetative tissue of its anthers (Fig. 2). It

shows a highly abnormal meiotic behaviour such as formation and non-disjunction of multivalents, lagging of chromosomes, unequal distribution of chromosomes to the two poles during



FIGS. 1 and 2. Somatic Chromosomes of the seeded variety "Lucknow 49" ($2n = 22$) and the "Seedless" variety ($3n = 33$) respectively $\times 4000$ approx.

first anaphase, formation of micronuclei, etc. 77 per cent. of chromosomes associate to form trivalents during the first division. This high percentage of trivalent formation, and the somatic chromosome number of $2n = 33$, clearly show the autotriploid nature of the variety, which obviously is responsible for the absence of seeds.

The above appears to be the first record of triploidy in guava. The presence of a triploid as reported here shows the existence of polyploidy in guava.

Cytogenetical Laboratory, L. S. S. KUMAR.
College of Agriculture, S. G. RANADE.
Poona 5,
February 2, 1952.

* A collection of Indian varieties of guava (*Psidium guajava* Linn.) is maintained at the Ganeshkhind Fruit Experimental and Research Station, Kirkee, and in the Modi Bagh of the College of Agriculture, Poona.

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2. Darlington, C. D. and Janaki Ammal, *Chromosome Atlas of Cultivated Plants*, 1945. George Allen & Unwin Ltd., London.

OCCURRENCE AND INHERITANCE OF 'FILICOID' FORM IN *CICER ARIETINUM* L.

BENGAL GRAM, *Cicer arietinum* L., is found to be much susceptible to mutations and one frequently comes across abnormalities in normal crops or in hybrid generations.^{1,2} The following is a report of one such instance.

In the F_3 progeny of a cross between *Cicer arietinum* L. var. *alternifolia*—a mutant breeding true for its alternate leaflet arrangement—and a normal leaved gram plant grown in 1948, eight fern-like plants with very small leaflets were traced. As they were very different in respect of branching, leaf and leaflet arrangement from either the F_1 or the F_2 progeny which segregated into 31 normal-leaved plants in which the leaflets are mostly placed opposite

each other in pairs: 8 *alternifolia*, it was suspected that the new plants appeared as a result of mutation. These came from the F_2 plant No. 20 which had the alternate leaflet arrangement. The F_3 progeny consisting of 37 plants segregated into 29 *alternifolia* and 8 *filicoid* or fern-like but sterile plants. This agrees with the 3:1 ratio in spite of the small number of plants.

Description of the Filicoid Variety.—The fern-like segregate mentioned above was found to have unusually small, narrow leaflets measuring 5 mm. \times 1.5 mm. as compared to those of the normal ones measuring 7 mm. \times 4 mm. The plants had profuse lateral branches with extremely short internodes. The large number of branches crowding all around the main stem gave the plants a cylindrical appearance, there being almost no secondary branches. All the leaves on a branch were almost uniform in length. The leaflets were oblique and densely placed on the mid-rib, their arrangement being irregular and alternate. Rudimentary floral buds were borne in the axil of every leaf. The perianth had a globular appearance and the anthers were devoid of pollen. The keel petal was altogether missing. All the eight plants noticed in 1948 were found to be entirely sterile. For the sake of convenience of identification this mutant type has been named by the author as *Cicer arietinum* L. var. *filicoid*.

The F_4 Generation.—Out of the 29 fertile alternate-leaved plants obtained in the F_3 generation, seeds of 21 plants were sown to raise the fourth generation of the cross in 1949 which gave the following type of plants:

- (1) Progenies of 8 families consisted entirely of fertile plants.
- (2) Progenies of 13 families gave 425 fertile *alternifolia*s 141 *filicoid*—an extremely good fit on the basis of an expected monohybrid ratio 424.5 *alternifolia*: 141.5 *filicoid*.

In the F_4 generation too some of the progenies continued to segregate into *alternifolia* and *filicoid* plants in the proportion of 3:1.

The sterile nature of the mutant plants leads one to suspect that the mutation reported above may be a case of chromosomal abnormality.

Cytological examination is now being undertaken to verify this point.

Agricultural Officer, G. P. ARGIKAR.
Rice Breeding Station,
Bulsar,
Bombay State.
January 31, 1952.

1. Areikar, G. P., Unpublished.
2. Bhat, N. R. and Argikar, G. P., *Heredity*, April 1951, **5**, Part 1 143-46.

CYTOLOGY OF ADHATODA VASICA NEES

The genus *Adhatoda* is represented in India by two species,¹ of which *A. vasica* is common throughout the country and forms a characteristic feature of the vegetation of Delhi Ridge. It has important medicinal properties. The only previous record on the cytology of the genus is a report of the haploid chromosome number ($n=17$) by Pathak, et al.² Additional details are given below.

Meiotic behaviour has been studied from smears fixed in Belling's modification of Navashin's fluid and stained with crystal violet. Somatic chromosomes have been examined from root-tips fixed by the oxy-quinoline method of Tijo and Levan as modified by Sharma and Ghosh.³

Meiotic division of the pollen mother cells is normal and regular. During diakinesis 17 bivalents are clearly seen scattered within the nucleus (Fig. 1). Metaphase is normal (Fig. 2)

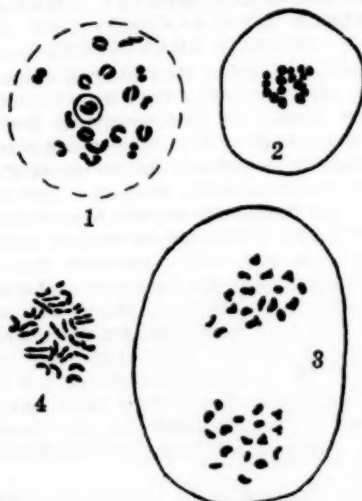


FIG. 1. Diakinesis showing 17 bivalents within the nucleus (scattered drawing); Fig. 2. Metaphase plate showing secondary association; Fig. 3. Second division metaphase with 17 chromosomes in each plate; Fig. 4. Somatic metaphase plate. Figs. 1-3 ($\times 1,200$); Fig. 4. ($\times 1,800$).

and followed by a regular disjunction of bivalents in anaphase. An indication of secondary association between bivalents is apparent in the metaphase plates. The second division takes place after a short interphase, and 17 chromosomes are seen clearly in both the plates (Fig. 3), confirming the haploid number as $n=17$. The two spindles may be arranged

parallel (as in the figure), or at right angles to each other.

The somatic plates contain 34 chromosomes (Fig. 4), which are very short and vary from 0.8 to 2μ in size.

Among the 7 other genera of the Acanthaceae (*Hygrophila*, *Justicia*, *Ruellia*, *Thunbergia*, *Acanthus*, *Eranthemum* and *Daedalacanthus*) whose chromosome numbers are known^{2,4} only *Ruellia* has 5 species with $2n=34$ chromosomes.⁵ Whether this similarity indicates a closer affinity between the two genera remains to be seen, although there is no such indication from pollen⁶ or floral morphology.

Thanks are due to Prof. P. Maheshwari for facilities and encouragement.

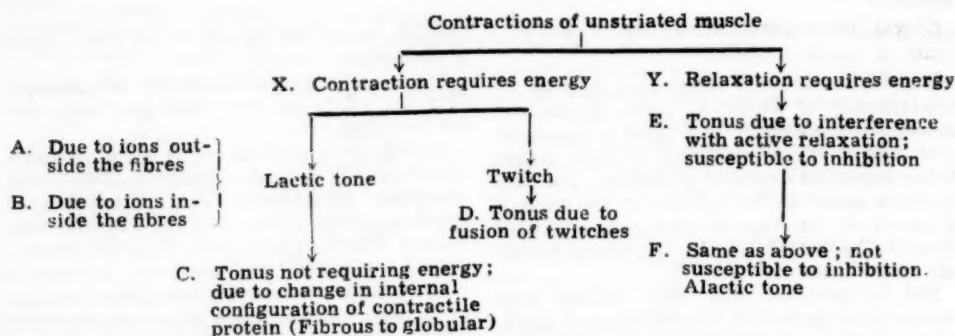
Botany Department, S. K. MUKHERJEE,
University of Delhi,
Delhi 8,
February 6, 1952.

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2. Pathak, G. N., et al., *Curr. Sci.*, 1949, 18, 347.
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4. Darlington, C. D. and Ammal, E. K. J., *Chromosomes Atlas*, 1945.
5. Bowden, W. M., *Amer. J. Bot.*, 1940, 27, 357-71.
6. Bhaduri, S., *J. Dept. of Sci., Cal. University*, 1, 1944, No. 4.

MECHANISM OF TONUS IN UNSTRIATED MUSCLE

UNSTRIATED muscle produces sustained tension under many different conditions. These tonic contractions can be divided into two groups, those which are susceptible to prolonged asphyxia and those which are resistant. To the former belong the twitch contraction and lactic tone and to the latter, alactic tone.^{1,2,6,7} It has been shown that in frog's and dog's stomach muscles, these two contractions are subserved by different contractile mechanisms. This was shown by experiments in which either contractile mechanism could be mechanically disrupted without affecting the other two.^{3,4,5,8,10,11}

These experiments were repeated on *Mytilus* unstriated muscle. In over 12 experiments, it was not found possible to dissociate the twitch contraction produced by alternating or direct currents, from tone by destroying either of these with sudden stretching (Fig. 1). In this muscle, therefore, the two kinds of contraction are subserved by the same contractile mechanism. This is in agreement with the other findings, that active relaxation is absent in this muscle and that its contractile mechanism differs from the other muscles in which active relaxation has been found.⁹ The various sustained contractions of unstriated muscle may now be summarised as follows:^{5,10}



There are six ways in which unstriated muscle can produce sustained tension. The contraction A, due to ions outside the fibres, and B, due to ions inside the fibres are antagonistic.¹² They are akin to the contracture of

1949, 30, 263. 4. —, *Ibid.*, 1950, 31, 351. 5. —, *Ibid.*, 1951, 33, 165. 6. —, *Curr. Sci.*, 1947, 16, 259. 7. —, *Ibid.*, 1948, 17, 321. 8. —, *Ibid.*, 1951, 20, 130. 9. —, *Ibid.*, 1951, 20, 237. 10. —, *Nature*, 1950, 166, 647. 11. —, *Ibid.*, 1951, 167, 564. 12. Singh, I., *J. Physiol.*, 1938, 92, 62.



FIG. 1. *Mytilus* muscle. Stimulated with direct current (14 volts for 10 seconds) between arrows at D. C. Put under tension at X, and tension destroyed by sudden stretching at Y.

striated muscle. C is the tonic mechanism of *Mytilus* muscle.⁵ D is akin to tetanus of skeletal muscle. E is susceptible to inhibition and F is resistant. F is the basic tone found in all frog's and mammalian unstriated muscle. It is akin to rigor mortis of striated muscle, so that what is a terminal contraction in striated muscle, is a physiological one in unstriated muscle. The contractions of striated and unstriated muscle are therefore closely related. With the exception of C, the group X is susceptible to asphyxia, and group Y is resistant. A contraction starting as D, may pass into A or B and thence into E and finally into F.

Lab. of Physiology, Inderjit Singh.
Yale University School of Medicine,
February 16, 1952.

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TROPICAL PULMONARY EOSINOPHILIA—PRELIMINARY NOTE ON ANIMAL EXPERIMENTS AND THE HIRST'S PHENOMENON

THE disease Tropical Pulmonary Eosinophilia is very common in India. Four important features of the disease are now recognised, history of persistent cough with or without breathlessness, eosinophilic leucocytosis, miliary mottling on the chest, X-ray in about thirty-five per cent. of cases, and therapeutic response to arsenic in most cases. Earlier confusion² of tropical pulmonary eosinophilia with other pulmonary eosinophilias of known etiology like pulmonary schistosomiasis, pulmonary amoebiasis, allergy asthma, etc., may have been responsible for the opinion that tropical pulmonary eosinophilia has multiple causes. The constant features of the disease, however, suggest that a single cause may be involved. Further, in every case, the known etiologic agents of pulmonary eosinophilia are absent.

With reference to the etiology of tropical pulmonary eosinophilia² we have the following results to present:

In Vivo Tests

A group of 40 mice inoculated intraperitoneally and intravenously with bacteria-free (seitz-filtered) blood and sera of patients shows an increase of eosinophil cells from 2 per cent. to 16 per cent. Blood from such inoculated mice failed to incite a rise in eosinophils in healthy mice.

With rabbits, it was observed that eosinophil cells are almost impossible to distinguish from

pseudo-eosinophil (granulocytes) cells,⁶ as the granules of the neutrophils are eosinophilic for the most part.

Progressive increase in eosinophil cells was recorded in the case of five monkeys inoculated intraperitoneally with the blood and sera of patients suffering from the disease. In 19 days, the percentage of eosinophil cells increased from 2 to 14. There has been a corresponding increase in total leucocytic count from 6,000 to 13,000 per c.mm. of blood. The work is being continued.

In Vitro Tests

Agglutination of erythrocytes by viral agents, Hirst's phenomenon,³ has been useful in investigative and diagnostic work¹ and many workers in recent years have demonstrated its applicability to study a number of viral infections. In our work, out of seven patients' sera examined, six have been observed to agglutinate chicken red cells. The hemagglutination titre has not reached more than 1:32 in cases examined (see Table I).

So far as we know, this is the first record of the demonstration of the Hirst's phenomenon in tropical pulmonary eosinophilia. Low hemagglutination titre of the patient's sera and small rise in per cent. eosinophils in animals inoculated with bacteria-free sera, are points worth noting. Whether such co-relation exists between *in vitro* and *in vivo* test cannot be said at present. Work with sputum has, therefore, been taken up with a view to obtain higher hemag-

glutination titre and greater per cent. of eosinophils on experimental animals.

TABLE I
Hemagglutinating activity of sera of patients suffering from tropical eosinophilia with chicken erythrocytes

Patient	Initial two-fold dilution of fluid							
	1	2	3	4	5	6	7	8
1	++	++	++	++	±	0	0	0
2	++	++	+	±	0	0	0	0
3	++	++	++	±	0	0	0	0
4	++	++	++	++	±	0	0	0
5	++	++	+	±	0	0	0	0
6	++	±	+	+	0	0	0	0
7	0	0	0	0	0	0	0	0

Degree of Agglutination:—

++ Complete; + Partial; ± Faintly positive; 0 Negative.

Our thanks are due to Dr. D. L. Shrivastava, Assistant Director (Planning), and Dr. B. Mukerji, Director, Central Drug Research Institute, for their keen interest in the work.

Central Drug Res. Inst., B. M. GUPTA.
K. G. Medical College S. S. MISRA.
& Hospitals, Lucknow, SAMI HAMEED. *
January 7, 1952.

* Working under Fellowship from Indian Council of Medical Research.

1. Burnet, F. M., *Austral. J. Sci.*, 1945, **8**, 81-83.
2. Ball, J. D., *Trans. Royal. Soc. Trop. Med. Hyg.*, 1950, **44** (3), 237-50.
3. Hirst, G. K., *Science*, 1941, **94**, 22-23.
4. Wintrobe, M. M., *Clinical Hematology*, p. 819, Lea and Febiger, Philadelphia, 1949.

COUNCIL FOR NUCLEAR RESEARCH IN GENEVA

A COUNCIL of Representatives responsible for planning an International Laboratory and organizing other forms of co-operation in nuclear research has been set up with headquarters in Geneva, following a five-day conference organised by UNESCO.

This body will have an independent legal status and will be responsible for all future planning. It will also conclude a special agreement with UNESCO and will co-operate with that organization. Its budget will total \$200,000 to be contributed to by its member states. It is expected that this will lead to the creation of an International Nuclear Research Laboratory, the location of which will be decided later.

The Conference agreed that one task of the Council will be to organize a study group at the Copenhagen Institute for Theoretical Physics. This group will survey the present situation in atomic physics with special regard to the work to be undertaken by European co-operation. It will also study problems which

may be tackled with equipment already in existence and to be operated on a European basis. It will endeavour to stimulate European collaboration by furthering contacts between scientists in different countries and by offering possibilities for younger physicists to take part in the research work carried on in the Copenhagen Institute.

The Council is to consider an offer from Liverpool University to provide special facilities for a number of European physicists to work there. The University has agreed to take four experimental physicists for at least one year, two cyclotron engineers for a shorter period, and one or two theoretical physicists.

Among the forty delegates and observers who participated in the Conference were: Niels Bohr (Denmark), Werner Heisenberg (Germany), and Sir George Thomson (United Kingdom). There were also observers from Austria, Japan and the Council of Europe.

REVIEWS

Application of the Electronic Valve in Radio Receivers and Amplifiers, Book IV. By B. G. Dammers, J. Haantjies, J. Otte and H. van Suchtelen. (Published by N. V. Philips' Gloeilampenfabrieken-Eindhoven, Netherlands), 1950. Pp. 024-416. Price Rs. 24.

The authors have produced an excellent treatise dealing with all the details of receiver design in the R.F., I.F. and detector stages and a welcome addition to the limited number of texts available in this field. The next volumes in the series (in preparation), Books V and VI, are meant to deal with the audio and power supply stages. A very desirable feature of the book is the extensive use of graphs and numerical examples based on existing valve types. Although a casual glance at the book shows considerable mathematical symbols, a knowledge of the mathematics of the conventional circuit theory is adequate for understanding the text. Each chapter is followed by extensive references to original papers.

The subject-matter of the book is divided into five chapters: Chapter I deals with R.F. and I.F. amplification, and gives a thorough discussion of tuned circuits, band-pass filters used in the R.F. and I.F. stages, the various methods of coupling the antenna to the first R.F. valve, I.F. stage design, etc. Chapter II deals with the problems connected with frequency changing. Several types of oscillator circuits are discussed in detail and methods of obtaining constant heterodyne voltage over each of the wave bands are discussed. Attention is also given to a consideration of the parasitic effects such as squegging and interaction between oscillator and input circuits. A brief discussion of the transit-time effects and the causes of frequency drift due to the mixing valve are also considered. Chapter III deals with the so-called tracking problem, that is, of maintaining a constant difference between the heterodyne oscillator frequency and that of the input circuits over the whole wave band. Algebraic and graphical methods of calculating the oscillator circuit constants are given. Chapter IV considers the parasitic effects and distortion such as modulation hum, cross modulation, superheterodyne whistles, etc., arising in the R.F., I.F. and mixer stages. Chapter V, the last one in this book, deals with the principles of detection and gives

a detailed discussion of the 'linear' diode detection.

Although the book should find its greatest use in the hands of the receiver designer, it is not much to say that it will also be of use to all those engaged in related fields.

B. S. RAMAKRISHNA.

Electrical Engineering Economics, Vol. II. Costs and Tariffs in Electricity Supply. By D. J. Bolton. 2nd Edition (Revised). (Chapman & Hall, London), 1951. Pp. 307. Price 30 sh.

The volume under review is the completely revised second edition of the author's book, first published in 1938, which has been long out of print. As pointed out by the author, the aim of his two-volume book on Electrical Engineering Economics is to give to practising engineers and students a plain account of such elementary economics as most nearly concerns them, together with its application to certain engineering problems.

The book has been, for convenience, divided into four parts, viz., Theory of Price-fixing; Costs; Retail Tariffs; and Power Factor Costs and Tariffs. New material has been included on Marginal cost and Price structure, Classification of cost details. The two new chapters on Allocation of Demand Costs and Load Studies are very useful in understanding the basis of charging commensurate with the individual's contribution to system demand. After discussing the pros and cons of the peak responsibility and demand methods of cost allocation used in the past, the author has shown that the E.R.A. method is a practical improvement on either of the two. He has also indicated the drawbacks in the E.R.A. method and his suggestions for its refinement.

The chapters on General Survey of types of structure and Domestic Tariffs have been completely recast. A new chapter has been added on Time-variable Tariffs and Restrictions in the part on Retail Tariffs. According to the author a scientific tariff should be a combination of two-part tariff based on floor area and time-of-day tariff. A very useful addition for general reference work is the glossary of terms as defined by the British Standards Institution and the Electrical Research Association.

The book meets a long-felt need for an up-to-date work on the theory and practice of Tariff Structure in the electric supply industry. From the students' point of view, addition of more problems and examples would have been welcome.

C. S. GHOSH.

Stainless Iron and Steel. Vol. I. By T. H. G. Monnypenny. (Chapman & Hall), 1951. Third Revised Edition. Pp. 523.

When an early pioneer in the field of stainless steels like T. H. G. Monnypenny, publishes a revised edition of his original treatise, the reader would expect a very complete review of the entire development upto the present stage. The expectations are actually fulfilled in this complete and excellent compilation. Besides the stainless steels mentioned in the title, heat-resisting steels are also dealt with.

Chapter I classifies the commercial steels into hardenable, ferritic and non-hardenable austenitic stainless steels. For hardenable steels, the maximum carbon content of which is increased up to 0.8 per cent. the typical example quoted is that of a high carbon valve steel. This steel has proved to be rather brittle and difficult to work. Examples of steels containing either 0.6 or 0.8 per cent. C in combination with 16 to 18 per cent. Cr and additions of molybdenum and copper, which are not considered in the book and which are used frequently for parts requiring higher hardness, wear resistance and cutting efficiency, would have been more appropriate.

Chapter II deals with the forging, rolling, heat treatment, surface hardening, descaling, cold working, machining, welding and soldering and the behaviour of stainless steels during these operations. One important aspect which should belong to this chapter, viz., the casting of such steels, has been omitted. This omission is noticeable especially as a wide range of alloys have been specially developed for casting purposes, and as controlling the primary structure is important because of its very great influence on the hot workability of such steels. The remaining sections, and particularly the one on nitriding stainless steels offer very detailed and complete information.

In Chapter III, the phenomena of corrosion resistance has been dealt with on the basis of the passive film theory only, although other explanations are possible. The attack of different corrosive media and the resistance of the best suited steel compositions under such con-

ditions is the subject of the most extensive part of the book. One of the problems, not yet satisfactorily solved is the corrosion resistance against sulphuric acid. But there are certain developments in this respect which are not reported up to date.

In Chapter IV dealing with the behaviour of heat-resisting steels at high temperatures, the scale-resistance in different atmospheres at temperatures above 500°C. and creep resistance, the development of alloys for the construction of the internal combustion turbine come in for a detailed review. It would have been of interest, if the development in the construction of gas turbines, which is different, had been incorporated. This has led to the development of ferritic steels containing 1 to 2 per cent. molybdenum preferred by the designers because of their lower expansion, and to austenitic steel of the type 16 per cent. Cr., 13 per cent. Ni with titanium or columbium additions.

Because of the very wide application of stainless and heat-resisting steels, the last chapter on the choice of stainless steels for industrial purposes has been limited to some of the most important application purposes only. The metallography of these types of steels has been but briefly mentioned and will be considered as the subject of a second volume "Microstructure and Constitution", which is to be published later. The omissions mentioned above do not in any way diminish the value of the book, which is a really wonderful source of information to students and experts in this special field of metallurgy.

H. SCHRADER.

Chemistry of Muscular Contraction. By A. Szent-Györgyi. (Academic Press Inc., New York), Second Edition, 1951. Pp. ix + 162. Price \$ 4.50.

This revised edition of a book published under the same title by the author in 1946 has been enlarged to include another publication of his on "The Nature of Life" (1949). The first edition received some very harsh criticism (cf. K. Bailey, *Nature*, 1947, 160, 550), largely because of the completely unorthodox style and the daring as well as novel approach. In the present edition, the weaker points of the earlier work have been sifted out and new observations are made. Nevertheless, many of the views advanced may yet remain contentious since the author has not considered contemporaneous work not in agreement with his postulates.

The book, it should be stated, is not a treatise on muscle chemistry; rather, it is an exposition, rendered in inimitable style, of the author's views concerning the physico-chemical basis of muscle action based mainly on the work of his own group. The hypothesis compares the role of ATP, the "master substance", in the contraction of intact muscle and its chemical effect in "super-precipitating" the muscular substance from muscle homogenates in presence of certain inorganic ions, particularly K^+ and Mg^{++} . Thus, "super-precipitation is contraction without architecture", contraction itself being "precipitation within the structure". The nature of this muscle substance has been further investigated and is shown to contain two specific proteins, myosin and actin, forming the highly viscous actomyosin. This endergonic synthesis of actin and myosin into actomyosin or its reversible dissociation is governed by ATP. The stages in muscle action are summarised as:

Rest: actin + myosin-ATP!

Excitation: actomyosin-ATP!

Contraction: actomyosin-ATP.

Relaxation: actomyosin-ATP \rightleftharpoons actomyosin-ADP + phosphate.

In the foregoing scheme, the presence of a high-energy link is represented by the exclamation mark; the ADP is rephosphorylated by creatine phosphate and the creatine phosphatase system. The various aspects of these interconversions are discussed, particularly from thermodynamic and electron-transfer points of view.

The idea of the contractile substance myosin acting as an enzyme ATPase (at pH 9) is unique and provides an understanding of energy coupling, i.e., the relation of the energy-liberating chemical process and the energy-consuming physical process, telling us how chemical energy can be converted to mechanical work in the animal body.

Myosin also acts as a desamidase for adenosine at pH 6, splitting off the amino group in the 6 position of adenosine. The ATPase activity of myosin is linked to the presence of free SH but it is not known whether the SH is also a prerequisite for desamidase activity.

There is no doubt that the many fascinating views presented in this thesis will stimulate much further work on muscle chemistry and thus lay the foundation for a more thorough understanding of the living state.

A. SREENIVASAN.

The Pectic Substances. By Z. I. Kertesz. (Interscience Publishers, New York), 1951. Pp. xvi + 628. Price \$ 13.50.

Literature on pectic substances is widely scattered and full of contradictory statements. The few attempts that have been made to collate information have covered only particular aspects of this interesting as well as important group of substances; Hinton's book on "Fruit Pectins" (1940) may be cited as an instance. This circumstance as well as recent definite advances to our knowledge of the field makes the present monograph a timely and welcome addition.

The book gives a critical presentation of the chemistry, biochemistry, botany, manufacture and applications of pectic substances. To deal with such a diversity of topics calls for a difficult task which Professor Kertesz has admirably succeeded in accomplishing. His life-long and active association with investigations on pectic substances entitles him to write on the subject with singular authority and clarity.

The book is presented in five parts. The first part deals with the chemistry of pectic substances and includes definitions and nomenclature, composition, structure, preparation, purification, determination and characterisation. The second part embodies the botany of pectic substances—their occurrence, distribution, genesis in relation to hemicelluloses and lignin and possible functions in plants. Part III characterizes the pectic enzymes. Part IV sets forth manufacturing methods from various raw materials while Part V describes the functions and applications of pectic substances and pectic enzymes.

The author has discussed the topics in an interesting manner emphasising the interrelations between fragments of information and citing the investigations of almost every worker in this field with due consideration. The work is throughout illustrated with flow diagrams, charts, data and tabular statements. This comprehensive monograph is indispensable to all workers interested in the various aspects of the science and technology of the group of pectic substances.

A. SREENIVASAN.

Annual Review of Biochemistry. Vol. XX. Edited by J. M. Luck and others. (Annual Reviews Inc., Stanford, California), 1951. Pp. ix + 648. Price \$ 6.00.

The first thought that occurs to the reviewer is to express his grateful appreciation of the two decades of brilliant service which the

Annual Review of Biochemistry has rendered to the progress of Biochemistry. To have maintained the standard of the series ever high and to have kept abreast of the progress in a rapidly expanding field of science, during the last 20 years, constitute an achievement of which Dr. Luck, who sponsored the venture, may be proud. In the present volume, twenty-one topics are reviewed, each one by an active authority on the subject. It is a matter of some satisfaction to readers of *Current Science* that one of our leading organic chemists, Dr. T. R. Seshadri, has reviewed the Biochemistry of Natural Pigments—a subject to which he has been devoted during his entire research career.

Other topics covered by the volume are: Biological oxidations by R. Wurmser, Non-oxidative, Non-proteolytic Enzymes by W. R. Frisell and L. Hellerman, Carbohydrate Chemistry by H. O. L. Fischer and D. L. Macdonald, The Polyuronides by C. L. Hinton, Chemistry of the Lipids by K. F. Mattil, The Chemistry of Amino Acids and Proteins by K. Bailey and F. Sanger, X-ray Crystallographic Studies of Compounds of Biological Interest by R. B. Corey, Nucleic Acids, Purines and Pyrimidines by J. Baddiley, Lipid Metabolism by S. Gurin and D. I. Crandall, The Metabolism of Proteins and Amino Acids by H. Borsook and C. L. Deasy, Biochemistry of Steroids by S. Lieberman and K. Dobriner, Fat-soluble Vitamins by H. Dam, Nutrition by H. J. Almquist, Biochemistry of Cancer by A. M. Brues and E. S. G. Barron, Biochemistry of Antibiotics by R. L. Peck and J. E. Lyons, Immunochimistry by M. M. Mayer, The Metabolism of Drugs and Toxic Substances by R. T. Williams, Biochemical Genetics by N. H. Horowitz and H. K. Mitchell, Carbohydrate Metabolism by S. P. Colowick and N. O. Kaplan and water-soluble Vitamins by G. Emerson and K. Folkers.

We wish the series a great future no less prosperous and brilliant than its past.

Advances in Enzymology and Related Subjects of Biochemistry. Vol. XI. Edited by F. F. Nord. (Interscience Publishers, Inc., New York), 1951. Pp. viii + 471. Price \$9.00.

The volume contains nine articles. The first one relates to a discussion of the nature of entropy and its role in biochemical processes by Herbert Gutfreund of Cambridge. Defining the thermodynamic function, entropy, both from the historical and mathematical points of view, the author proceeds to describe various physical processes which may be of some importance

in the mechanism of chemical and biological reactions. The second article on Reactions at Interfaces in Relation to Biological Problems by J. F. Danielli and J. T. Davies is one of fundamental interest to biochemists in general, and enzymologists in particular. The vital significance of surface is realised if attention is called to the very large surface area of the cell membrane, nuclear membrane, chromosomes and other discreet entities such as mitochondria, vacuoles, golgi apparatus, etc., which generally constitute the cell. In addition, the surface offered by the colloidal molecules like proteins, carbohydrates and nucleic acids and by the particulate micelles composed of fatty emulsions, etc., add to the enormity and complexity of surfaces and surface reactions. The article forms a brilliant exposition of this intriguing subject.

The discussion of the highly controversial subject of chlorophyll fluorescence in relation to the intriguing process of photo-synthesis presented by E. C. Wassink, serves to clarify the position of the problem and stimulate further studies. E. S. Guzman Barron has presented a critical and stimulating survey of the extremely reactive thiol groups in relation to biological activity.

A review of the Pectic Enzymes representing a generic group of enzymes, which have attained industrial importance, has been made by Hans Lineweaver and Eugene F. Jansen. Enzymatic synthesis of polysaccharides is a recent subject of great significance to enzymology. Edward J. Hehre who has picturesquely described the reaction as a biological type of polymerisation, has presented a thought-provoking review of the present position of this new and promising field of biochemistry.

The other three chapters of the volume relate to the Biological Transformations of Starch, by Stanley Peat; Chemical Investigations of Alliin; The Specific Principle of Garlic, by Arthur Stoll and Ewald Seebach; Some Problems of Pathological Wilting in Plants, by Ernst Gümman. A cumulative index—author and subject—covering all the 11 volumes, is appended to this volume. Professor Nord is to be congratulated on this brilliant array of inspiring contributions which comprise the eleventh volume of the *Advances*.

Hydroponics: The Bengal System. By J. Sholto Douglas (Oxford University Press), 1951. Pp. xii + 147. Price Rs. 6.

In 1929, Prof. W. F. Gericke, of the University of California, reported an interesting

application of the principle of water culture and named his method of growing plants 'hydroponics'. The yields thereof were comparatively high: e.g., potatoes at the rate of 2,500 bushels to the acre where the average soil production was only 116 bushels; and tomatoes yielded fruits in 60 days, some averaging 24 lb. per plant.

In the booklet under review, the author has given a popular account of his experimental studies on the soilless culture of plants carried out during 1946-49 at the Bengal Government Experimental Farm at Kalimpong in the Darjeeling District. It is reported to require neither elaborate equipment nor expensive appliances. The hydroponic troughs may be made of wood, concrete, asphalt impregnated mats or roofing felt, asbestos sheets, bricks and mortar, mud plaster, puddled alkali-treated clay, iron or steel, which have all been used with success. The troughs are filled up to a depth of six inches with coarse inert aggregate, which may consist of gravel, crushed stone, cinders, broken brick or granite chips of $\frac{3}{8}$ " to $\frac{1}{2}$ " size, to which has been added a certain proportion of sand or residual dust. This mixture, which is described as a novel feature of the Bengal system, is the hydroponic substitute for soil for supporting plant roots. Irrigation water may be supplied by means of a bamboo piping system or from a rubber hose. Details of other items and about the various operations, such as sowing of seeds, transplanting seedlings, preparing suitable mixtures of chemicals and applying the nutrients, together with a number of diagrams and photographs illustrating the technique and some of the results, are also given, so that an aspiring hydroponicist could easily learn the new method. By this method forty different crops (rice, wheat, maize, potatoes, soya-beans, oats, beet-root, peas, tomatoes, etc.) were grown successfully during the experimental seasons in the period 1946-49, and the crop yields and the cost of production are recorded. The hydroponic yields in most cases were much higher than the yields obtained by ordinary agriculture: e.g., tomatoes at the rate of 140 tons per acre where the soil production was only 5 to 10 tons per acre. The estimated revenue from the hydroponicum is also very encouraging: the grower would be left with a net profit, at a conservative estimate, of Rs. 20,000 yearly from each acre of his soilless culture installation.

The Bengal system may perhaps appeal more to townspeople interested in gardening, but who lack garden space. In addition to full instructions for the setting up of the hydroponicum

and its operation, the publication contains short notes on other systems of soilless culture and a brief, non-technical account of the elements of plant nutrition and deficiency symptoms, which would be found useful by the amateur gardener as well as the commercial grower. The book is well printed although a few typographical errors have slipped in (e.g., on for ion on page 64, line 8).

S. C. P.

Curare and Anticurare Agents. By K. R. Unna, D. Bovet, W. E. M. Paton and 28 other authors. *Annals of the New York Academy of Sciences*, Vol. 54, Art. 3. Pp. 297-530. Price \$4.00.

This is a comprehensive monograph reflecting the trend of research on curare, synthetic curare-like compounds and their antagonists.

The partial clarification and extension of the existing knowledge on the effects of d-tubocurarine on the central and autonomic nervous system and the studies on the action of curarising agents at the neuromuscular junction are ably presented by McIntyre and others. Dutcher describes the isolation and identification of additional alkaloids in chondrodendron tomentosum by the use of counter current distribution and chromatographic techniques. There is much activity in this field, but it is evident that unanimity of opinion does not exist on all fronts.

The renaissance in the history of curare-like drugs stems largely from the remarkable work of Bovet and his colleagues. Paton has given a critical review which throws considerable light on the numerous contrasts in experimental results between decamethonium and similar substances causing neuromuscular block. The effect of modification of the structure of decamethonium on its pharmacological properties has been discussed by De Baer, *et al.*

From being merely a tool in the hands of the pharmacologists, curare and the curarising drugs have now come to occupy a prominent place in the clinicians' armamentaria, and the surgeons' anaesthesia. Mention has been made of the clinical uses of d-tubocurarine in the various neuro-muscular disorders ranging from muscle spasm to spasticity, the place of curarising agents in convulsive and electroshock therapy and in various other groups of disorders.

Experimental details in evaluation of curarising drugs in man and the presentation of all the latest trends in research, render this a very desirable volume in the hands of research workers in this field of study.

M. SIRSI.

Elementary Genetics. By Wilma George. (Macmillan & Co., Ltd., London), 1951. Pp. vi + 171. Price 10 sh. 6 d.

The sub-title of this book is "The Physiology of Descent" and this describes the mode of treatment adopted. The fundamentals of genetics are briefly explained and modern developments in physiological genetics are indicated. The book begins with an account of cell theory, cell division and gametogenesis, and then passes on to a chapter on Mendelian heredity. Four more chapters deal with the topics, linkage, sex determination, mutation and chromosome mutations. The next four chapters deal with the Gene, its nature, its action and interactions, and its role in taxonomy. The last chapter gives a very brief account of the vast topic, genetics and evolution.

The book is meant to describe briefly to the non-specialist student the fundamental principles of genetics, and to explain the significance of recent developments in physiological genetics. Because of the novelty of treatment, the book is a useful addition to text-books in genetics. Limitation of space has prevented the author from dealing adequately with the abstruse topic: gene action as revealed by biochemistry. For understanding the latter half of the book, the student must know general biology. In page 103, a reference is made to the organising agent and its role in embryology. A student who knows this amount of biology, must be quite familiar with cell theory, cell division and gametogenesis. The pages devoted to these subjects could well have been devoted to explaining in greater detail the main theme of the book, and thus making the book more useful.

C. G.

Vitamins: A Digest of Current Knowledge. By Leslie J. Harris. (J. & A. Churchill Ltd., London), 1951. Pp. xii + 244. 84 Illustrations and 111 Structural Formulae. Price 15 sh. net.

This book provides a brief account of current knowledge about the vitamins for beginners in the study of vitaminology. The simple style and the historical approach in each case do indeed help in fulfilling this objective to some extent. The emphasis however has been throughout on clinical aspects rather than on biochemical functions of the different vitamins. Such important topics as relation of micro-organisms to the study of vitamins, the anti-vitamins and vitamin assay procedures do not find a place in this 'digest'. There is also no discussion of vitamin interrelationships nor is the account concern-

ing the chemistry and physiology of folic acid and vitamins B₁₂ up to date. The booklet is likely to be of use to the clinician and the dietetician rather than to the biochemist. The glossary of medical terms, the short but useful bibliographies and the numerous plates demonstrating vitamin deficiency syndromes are distinct features that recommend themselves very strongly.

A. SREENIVASAN.

Table of Dielectric Constants of Pure Liquids. By A. A. Maryott & E. R. Smith. N.B.S. Circular 514. (Govt. Printing Office, Washington, 25 D.C.), 1951. Pp. iv + 44. Price 30 cents.

The book contains the values of "static" dielectric constants of more than 800 substances in the liquid state, together with literature references upto 1950 presented in a concisely tabulated form; data are given both for E and dE/dt , which would be found very useful by research workers in the field.

Books Received

Hydrocarbons. (Published by the Faraday Society), 1951. Pp. 339. Price 35 sh.

Inventories of Apparatus and Materials for Teaching Science, Vol. 3. Part 3. UNESCO 19, Avenue Kleber, Paris, 1951. Pp. 139. Price \$ 2.50.

Intermediate Geometry. By L. J. Lacey. (M/s. Macmillan & Co.), 1951. Pp. xii + 363. Price 10 sh.

Fault Calculations. By C. H. W. Lackey. (M/s. Macmillan & Co.), 1951. Pp. xi + 295. Price 30 sh.

The Lipids, Their Chemistry and Biochemistry, Vol. I (Chemistry). By Harry J. Denel, Jr. (M/s. Interscience Publishers), 1951. Pp. xxiv + 982. Price \$ 18.50.

Chemistry of Carbon Compounds, Vol. 1. Edited by E. H. Redd. (M/s. Elsevier Publishing Co.), 1951. Pp. xxi + 777. Price not given.

Laboratory Instruments, Their Design and Application (First Edn.). By J. Home Dickson and A. Elliott. (M/s. Chapman & Hall), 1951. Pp. 414. Price 32 sh.

Rockets, Missiles and Space Travel, Second Edition. By Willy Ley. (M/s. Chapman & Hall), 1951. Pp. xii + 436. (22 Figs.) Price 30 sh. net.

Food and Food Products (The Chemistry and Technology of), Vol. III. By Morris B. Jacobs. (M/s. Interscience Publishers), 1951. Pp. xxx + 1773-2580. Price \$ 15.00.

- The Theory of Electromagnetic Waves* (A Symposium held under the auspices of the Washington Square College of Arts and Science). (Interscience Publishers), 1951. Pp. viii + 393. Price \$6.50.
- Prism and Lens-Making*. By F. Twyman, Hilger and Watts, Ltd., London, 1951. Pp. viii + 629. Price 58 sh. net.
- On Indian Insect Types*, Part I. By S. Bash-hood Alam. Edited by M. B. Mirza, Muslim University, Aligarh, 1951, 74, (9 plates). Price Rs. 5-8-0.
- The Science of Flames and Furnaces*. By M. W. Thring. (M/s. Chapman & Hall, Ltd.), 1952. Pp. 416. Price 42 sh.
- Carburation*, III Edition, Volume II. By Charles H. Fisher. (Chapman & Hall), 1952. Pp. xv + 279. Price 36 sh.
- Power System Analysis*. By J. R. Mortlock and M. W. Humphrey Davis. (Chapman & Hall), 1952. Pp. xv + 384. Price 45 sh.
- Quantum Theory of Matter*. By John C. Slater. (McGraw Hill Book Co.), 1951. Pp. xiv + 528. Price not given.
- Outlines of Farm Management*. By R. K. Misra, College of Agriculture, Gwalior, 1951. Pp. 48. Price not given.
- The Influence of Hormones on Enzymes*. Edited by Roy Waldo Miner. (Annals of New York Academy of Sciences), 1951. Vol. 54. Art 4, Pp. 531-728. Price \$3.50.
- The Kamar*. By S. C. Dube. (Universal Publishers, Ltd., Lucknow), 1951. Pp. xii + 216. Price Rs. 12-8-0.
- Mitchourine Lysenko*. By Jacob Segal. (Les Editeurs Francis, Paris), 1951. Pp. 141. Price Fr. 225.
- Testing of Measuring Equipment*. (A Manual for Weights and Measures Officials. National Bureau of Standards Handbook No. 45. U. S. Department of Commerce, Washington, 1951). Pp. vii + 205. Price not given.

SCIENCE NOTES AND NEWS

Antituberculous Thiosemicarbozone Compounds

With reference to a note of the above title in *Current Science*, 1951, 21, 10, Mr. S. Banerjee of the Bengal Immunity Research Institute, Calcutta, writes that work on similar thiosemicarbozone compounds has been published earlier by U. P. Basu and Samir Banerjee in *J. Ind. Chem. Soc.*, 1951, 28, 466.

Madras University Lectureships, 1952-53

Applications for Lecturerships will be received by the Registrar, not later than the 31st March, 1952. The lectures are ordinarily to be delivered before the end of January, 1953.

- (1) *The Maharaja of Travancore Curzon Lectureships* (3)—Three lectures of the value of Rs. 250 each, relating to (a) Medicine, Clinical, (b) Engineering and (c) Agriculture.
- (2) *The Sir Subrahmanya Ayyar Lectureship*: Value Rs. 250.

The lectures should be on a subject connected with Physical Science.

- (3) *Dr. Elizabeth Matthai Lectureship*: Value Rs. 300.

A course of not less than three lectures should be delivered on a subject embodying the results of original investigations in some branch of Medicine and Surgery, preference being given

to a subject having special reference to the requirement of Women and Children.

- (4) *The Dr. A. Lakshmanaswami Mudaliar Lectureship*: Value Rs. 500—

A course of not less than three lectures should be delivered at Madras on any subject pertaining to Medicine in any of the various departments including Medical Education, Medical Relief and Public Health and History of Medicine.

Johnston Pump Co. Scholarship

The Johnstone Pump Company have placed at the disposal of the Government of India a scholarship to be awarded to an Indian in ground-water development at the California Institute of Technology, U.S.A.

Applications are to reach the Ministry of Education, Governments of India, New Delhi, on or before April 15, 1952. Particulars and prescribed application forms can be obtained from the Ministry of Education, Government of India, New Delhi (Scholarships Division).

Plant Ecology of Arid and Semi-Arid Regions of S.-E. Asia.

Dr. F. R. Bharucha, Professor of Botany, Institute of Science, Bombay, has been commissioned by the UNESCO to prepare a report on

the plant ecology of the arid and semi-arid regions of Afghanistan, India and Pakistan. Information relating to the subject on (i) Geography and Geology, (ii) Climate, (iii) Soils, (iv) Hydrology, (v) Agriculture, (vi) Forests, (vii) Salt lands, (viii) Erosion, (ix) Sand dunes, (x) Floras, (xi) Physiological Studies on Transpiration, (xii) Past History of the arid and semi-arid zones and (xiii) Schemes, if any, worked to ameliorate these conditions, will be gratefully received and suitably acknowledged by him.

Award of Research Degree

The University of Poona has awarded the Degree of Doctor of Philosophy in Chemistry to Sri. P. G. Tulpule, for his thesis entitled "Studies on Fat Metabolism".

Indian Vegetables Oils as Fuels for Diesel Engines

In the fourth edition of this valuable bulletin which has been just now published by the *Council of Scientific and Industrial Research*, the information has been completely revised and brought up to date. Copies of this publication are available from the Publications Division, 20, Pusa Road, New Delhi-5. It is priced Re. 1 per copy, packing and postage extra.

Optical Instruments Manufacture at Dehra Dun

The Ordnance Factory at Dehra Dun is now in a position to offer a range of instruments such as research microscopes, dissecting microscopes, photographic enlargers and micron readers, for civilian consumption. Attempts are being made to cater, in adequate measure, to the needs of universities and colleges. An illustrated article describing some of the instruments being manufactured by the factory is to be found in the *J.S.I.R.* (Jan. 1952).

Antidote for Beryllium Poisoning

The Argonne National Laboratory, Chicago, has announced that aurin tricarboxylic acid (ATA) seems to offer promise in this connection. This chemical combines with beryllium salts by a similar reaction to that of dye fixation by metallic salts. The resultant co-ordination compound is a non-toxic substance. According to *Chemical Age* (Jan. 5, 1952), ATA has proved to be an excellent antidote in laboratory cases of animal poisoning with beryl-

lium, cases in which the amount of beryllium given would otherwise have been fatal. If ATA proves to be a satisfactory antidote to beryllium toxicity with humans, the use of this metal in atomic pile construction will become more likely.

Radioisotopes in Research

The Oak Ridge Institute of Nuclear Studies, Tennessee, is offering four-weeks' courses in the techniques of using radioisotopes in research at the rate of about six courses each year. Although most of the courses are over-subscribed by qualified United States' scientists, some courses may have one or more vacancies available for foreign scientists. Foreign nationals will however be accepted only when applications are approved by the applicants' Embassy or Legation and the United States Department of State.

The course is divided into laboratory work, lectures on laboratory experiments, general background lectures, and special-topic seminars. Laboratory experiments concern the following subjects: (a) Use and calibration of instruments, (b) Purification and separation of radio-active materials, and (c) Application of various radioisotope techniques of interest to investigators in all fields of research.

The seminars cover such topics as the principles and practices of health physics, design of radio-chemicals laboratories, dosimetry, and effect of radiation on living cells and use of isotopes in animal experimentation.

Asiatic Society

The following Officers of the Society were duly elected for 1952: *President*: Dr. S. K. Mitra, *Vice-Presidents*: Dr. M. Z. Siddiqui, Mr. K. P. Khaitan, Sir Paul Benthall and Dr. S. C. Law, *General Secretary*: Prof. J. M. Sen and *Treasurer*: Hon'ble R. P. Mookerjee.

Bulletin of the Electrochemical Society

The India Section of the Society have constituted an Editorial Board with Dr. R. M. Burns as Chairman and Dr. T. L. Ramachar as Regional Editor, for the publication of the Journal. The first number for January issued recently is of topical interest, and contains a section of abstracts from current literature, which should be quite useful to all electrochemists in India.

ANNOUNCEMENT

JOURNAL OF SCIENTIFIC & INDUSTRIAL RESEARCH

To accommodate the large number of original research papers coming in for publication and to facilitate speedy publication of such papers, the number of pages in the Journal has been increased from 64 to 100 from January, 1952.

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